IMPROVING THE UPT STUDENT FOLLOW-ON ASSIGNMENT SELECTION PROCESS

GRADUATE RESEARCH PROJECT

Michael G. Messer, Major, USAF

AFIT/IOA/ENS/06-07

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT/IOA/ENS/06-07

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GRADUATE RESEARCH PROJECT

Presented to the Faculty

Department of Operational Sciences

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Operations Analysis

Michael G. Messer, MS

Major, USAF

June 2006

AFIT/IOA/ENS/06-07

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Michael G. Messer, MS
Major, USAF

Approved:

Dr John O. Miller (Chairman) 5/31/06
date

Abstract

The Euro-NATO Joint Jet Pilot Training (ENJJPT) program at Sheppard AFB conducts Undergraduate Pilot Training (UPT) for 13 NATO nations with a focus on producing premier fighter pilots. As ENJJPT transitions to the new T-6 Texan II, the leadership is examining if the current assignment model meets the needs of the US Air Force for the US students. To assign US students, the Senior National Representative uses the Merit Assignment Scoring System (MASS) to rank order students and assign aircraft based on preference and availability of assignments. MASS accounts for every activity in pilot training as well as a subjective input from the instructors as to the overall attitude and performance of the student. The score obtained from the MASS is categorical by assigning a weighting to a particular category of performance. Currently, there is no direct link between the skills needed to fly modern fighter aircraft and the MASS. Additionally, many of the skills learned in pilot training span multiple categories and it is possible for a deficiency to be buried in the MASS score. The goal of this research was to identify the core skills required to fly the various fighter aircraft through the use of a Combat Air Forces (CAF) wide survey instrument, interviews, and working group inputs. An assignment model was created with a focus on assigning students based on skill strengths. After the core skills were identified and related to UPT events, a value hierarchy was created and a model developed to identify the best aircraft fit for a student based on their performance as related to the skill sets. This paper frames the issues, outlines the methodology used to define the skill sets, and discusses the development of the model. Finally, recommendations are made on future changes to MASS, the UPT student assignment process, and the pilot training syllabus.

Acknowledgments

I would like to express my sincere appreciation to ...

- My wife for her continued love and support through this tough year of education and for her English skills and reading and re-reading this paper
- My children for enduring the long hours of research and time away when they would rather have Daddy play with them
- Dr John O. Miller, AFIT/ENS for his guidance, wisdom and probing questions
- Lt Col Brad “Yukon” O’Connor, ENJJPT US SNR, as my chief champion
- Maj Bruce “Lumpy” Dobbins, 80 FTW/OG, the man at ENJJPT with vision and who can make anything happen
- Mr John “Dobi” Gillis, AETC/A3FI, for support and sponsorship of this project
- Mr Terry Sampson, AFIT/SC, who made all of the on-line surveys happen

Michael G. Messer

Table of Contents

Abstract ... *iv*

Acknowledgments ... *v*

Table of Contents ... *vi*

List of Figures ... *ix*

List of Tables ... *x*

I. INTRODUCTION ... 1

BACKGROUND ... 1

EURO-NATO JOINT JET PILOT TRAINING (ENJJPT) ... 3

RESEARCH OBJECTIVE ... 4

EXAMPLES ... 5

PAPER OUTLINE ... 5

II. PAST RESEARCH/LITERATURE REVIEW ... 6

CHAPTER OVERVIEW ... 6

FUTURE TRAINING AIRCRAFT ... 6

"CONCEPT: T-38C ENHANCED HUMAN PERFORMANCE TRAINING" ... 7

"BUILDING THE FIGHTER PILOT" ... 9

T-38 PREDICTORS STUDY ... 10

PILOT SELECTION MODEL ... 11

ENJJPT '08 ... 12

DECISION ANALYSIS ... 12

VALUE FOCUSED THINKING ... 13

VFT EXAMPLE ... 15

III. METHODOLOGY/DATA COLLECTION ... 18

OVERVIEW ... 18

INDEPENDENT REVIEW BOARD (IRB)/SURVEY CONTROL NUMBER (SCN) ... 19

FIGHTER CORE SKILLS SURVEY (FCSS) ... 19

SHEPPARD SURVEYS ... 20

ENJJPT MASS Working Group 21
Decision Analysis 22
Student Evaluation 23
IV. DATA COLLECTION RESULTS AND ANALYSIS 24
Summary 24
General Results 24
FCSS responses 25
Broad Area Comparisons 26
Sortie Type Comparison 29
Student Preference 30
Value Functions 30
Skills Breakdown 33
Sub-Skills score development 35
Sensitivity Analysis 36
Relating UPT events to Skills 37
Bottom Line 39
V. MODEL DEVELOPMENT AND ANALYSIS 40
Overview 40
Model Input 40
UPT Grading 41
Model Calculations 42
Specific Model Calculations 43
Sub-Skill Calculation Example 45
Model Output 46
Model Uses 47
Overall 48
VI. RECOMMENDATIONS 49
Overview 49
Policy Change 49

ENJJPT '08 PLAN ... 50
ASSIGNMENT MODEL ... 50
CHANGES TO UPT AND THE SYLLABUS ... 51
FOLLOW-ON TRAINING MODELS ... 52
VII. FUTURE RESEARCH ... 53
FURTHER VALIDATION AND INTERFACE ... 53
UPT CHANGES ... 53
FINAL THOUGHTS ... 54
Appendix A - Fighter Skills Survey #2 ... 55
Appendix B - Mini Survey #1 – UPT Skills Breakdown ... 60
Appendix C - Mini Survey #2 – Broad Area Skill relationships based on Fighter ... 61
Appendix D - Mini Survey #3 – UPT Weighting Breakdown ... 62
Appendix E - Updated Skills Survey ... 64
Appendix F Skills Survey Results ... 66
Appendix G UPT/Skill Relationships and Definitions ... 70
Appendix H Student Skills Survey ... 76
Appendix I ENJJPT Working Group Agenda ... 78
Bibliography ... 79

List of Figures

Figure 1 - Migrating Skill Requirements 8
Figure 2 - VFT Example Value Hierarchy 15
Figure 3 - VFT example Distance Piece-wise Linear Function 16
Figure 4 - VFT example Price Value Function 17
Figure 5- Original Broad Area Skills breakdown 24
Figure 6 - ANOVA results 26
Figure 7 - Broad Area Skills sets 27
Figure 8 – Skill Subset breakdown 28
Figure 9 – Sortie Classification breakdown 29
Figure 10 - General Skills Value Function 31
Figure 11 - Other Skills Value Function 31
Figure 12 - Specific Skills Value Function 32
Figure 13 - Student Preference Value Function 32
Figure 14 - General Skills Breakdown 33
Figure 15 - Other Skills Breakdown 34
Figure 16 - Skill Comparison Analysis #1 36
Figure 17 - Skill Comparison Analysis #2 37
Figure 18 - Student Preference input page 40
Figure 19 - General Skills input page 41
Figure 20 - Other Skills input page 41
Figure 21 - Aircraft Specific Skills input page 41
Figure 22 - General Calculation Flow 43
Figure 23 – Example Sub-Skill calculation 45
Figure 24 - Results/Output Table 47

List of Tables

Table 1 - Current ENJJPT MASS breakdown 2
Table 2 - General Skills breakdown data results 33
Table 3 – Other Skills breakdown data results 33
Table 4 - Specific Skills breakdown by aircraft 34
Table 5 - Sub-skills tabulation 35
Table 6 – PTS Excerpt from ENJJPT Syllabus 38
Table 7 - Skill definition excerpts 39
Table 8 - Grade Definitions 42
Table 9 – Example MIF Calculation 46

IMPROVING THE UPT STUDENT FOLLOW-ON ASSIGNMENT SELECTION PROCESS

I. Introduction

Background

Near the end of twelve intense and often heartbreaking months of training, a select group of military officers receive word of their next assignment and the aircraft they will fly. For many, it is an exciting and exhilarating time as they fulfill their dreams of becoming a fighter pilot. For some, disappointment rains down as they get their fourth, fifth or maybe even their last choice aircraft. And for some, the excitement of assignment night lasts only a short while as their flying experience turns into a nightmare when they fail to complete their follow-on training.

A few weeks after assignment night, these same officers complete one of the highest achievements of their careers – obtaining their wings. To reach this point, they have successfully completed the training prescribed in the AETC Undergraduate Pilot Training (UPT)[1] syllabus including completing 140 hours of flight in an aircraft, passing eight demanding check rides and enduring the scrutiny of experienced instructors.

The assignment system of students completing pilot training has changed relatively little over the years while fighter aircraft have been revolutionized. Leaps in technology have transformed the cockpits of the aircraft these pilots fly. Additionally, the interface between man and machine is no longer a simple gauge or switch but a multi-layered multi-functional display with Hands-On-Throttle-And-Stick (HOTAS) capabilities challenging even the most advanced students. Training aircraft have also improved. The T-6 Texan is allowing students to learn instrument flying skills in a similar glass cockpit to the F-15E, F-16 and F-22 aircraft they will

[1] UPT is the generic term for pilot training which includes UPT, Specialized UPT (SUPT), Joint SUPT and ENJJPT.

fly in combat. The T-38C also has glass cockpit instrumentation and challenges the students to not only fly a high performance machine but to multi-task and interface like never before.

The current assignment system uses the Merit Assignment Scoring System (MASS) which is a formula of weighted scores taken from graded events throughout training in various categories of training (see Table 1). Students are rank-ordered and given assignments based on a raw score. Although the categories are weighted, no specific *skill* area is graded and there is no relation of core skills needed in flying modern day fighters to UPT grading, evaluation, and assignment selection. As a result, the potential exists for lost training, which equates to lost money, by losing a student (washout) in follow-on training or requiring additional training when a deficiency could have possibly been identified at an earlier stage in the pipeline. Finally, there is little or no “reach-back” from the fighter community/units to relate skills needed to actual maneuvers flown in pilot training.

Table 1 - Current ENJJPT MASS breakdown

Flying					**70%**
Category Check Maneuver T-Score				**50%**	
T-37		T-38			
Contact	(16%)	Contact	(24%)		
Advanced Contact	(24%)	Instrument	(28%)		
Instrument	(24%)	Basic Formation	(20%)		
Formation	(20%)	Advanced Formation	(28%)		
Low Level	(16%)				
Daily Performance				**20%**	
Flight Line Test T-Score		(25%)			
Daily Maneuver T-Score		(75%)			
Academics T-Score					**10%**
Flight Commander Ranking T-Score					**20%**
Total					**100%**

UPT still needs to be the bedrock of basic skills but if the assignment system selects the student who can best fly an aerobatic loop verses who has the required skill to operate a complex machine under high G loading, students will continue to have problems as fighter aircraft advance in capabilities.

Euro-NATO Joint Jet Pilot Training (ENJJPT)

The 80th Flying Training Wing is located at Sheppard AFB in Wichita Falls, Texas and was established in 1986 as the ENJJPT program training student pilots from across NATO. Currently, thirteen NATO countries provide monetary support, nine countries provide instructor pilots, and five countries have students enrolled in the program. The Steering Committee (SC) meets twice a year to discuss policy and issues affecting ENJJPT and decide on future changes to the syllabus and training program.

Prior to graduating, the students select which follow-on aircraft they desire to fly. The reasons the students have for selecting an aircraft type vary and may include historical, instructor influence, family or personal reasons. The MASS score is used along with the student’s preference to match the individual to an available training slot. At ENJJPT, the US Senior National Representative (SNR) is the individual who matches the US students to available assignments. If a student is deemed not fit to fly a particular aircraft and no options are available, the US SNR will work to trade the aircraft assignment with another training base. This is most frequently used when a student is deemed not able to fly fighter aircraft and a bomber assignment is needed.

One final component of the assignment process is a subjective “Flight Commander” ranking. The instructors who have direct daily contact and fly with the student provide input to rank order the students in a class. This ranking results in a subjective score which counts toward

20% of the student's overall MASS score. The instructors consider the effort and attitude the student has put forth in the program and is very subjective. Although the current ranking system contains elements to prevent favoritism, it can be shown and has occurred where the number one pilot in terms of skill and flying ability ranks toward the bottom (10 out of 13) of a class in overall MASS score. Under the current assignment process, this particular student might not receive his/her aircraft preference. Several instructors have voiced concern over the ultimate impact the Flight Commander Ranking has on the student's future assignment and career.

ENJJPT is considered to be the premier pilot training program in the world. For US students, most students are assigned to fighter aircraft upon graduation. Students who do not meet a minimum level are assigned to a bomber aircraft. Generally, there are a limited number of bomber assignments per class.

Research Objective

The *ultimate goal* of AETC is to produce a pilot with skills which have the best possibility of graduating from follow-on programs. The objective of this research effort is to 1) identify Core Competencies (skill sets) required to fly modern fighter aircraft and 2) to develop an improved MASS using a composite "skills" score that will better predict future performance. The end result is to develop a relatively objective assignment system based on "skill sets", as opposed to categorical performance, which the US SNR at ENJJPT can use to assist in determining assignments for the students. This system could be used to identify potential deficiencies at earlier, less expensive stages of training recommending appropriate remedial actions to benefit both the student and the Air Force. This research provides such an assignment system in the form of an Excel based spreadsheet model which can be used on a standard desktop PC.

ENJJPT was selected as the primary focus of this research due to my background and familiarity with the program as well as the ENJJPT '08 initiative. As ENJJPT replaces the venerable T-37 with the new T-6 trainer in September of 2008, the leadership and SC felt the time was appropriate to conduct a top to bottom review of the program. AETC is also interested in the results and the potential implementation at the remaining UPT bases.

Examples

Throughout portions of this paper, examples will be presented to illustrate the model and the concepts behind the new assignment process. The situations and students are completely fictional and any similarities to an actual individual are purely coincidental.

Paper Outline

Chapter 2 will discuss previous efforts to identify and relate skills sets and discuss current on-going work in the improvement of UPT. Chapter 3 will present the methodology used to gather the data and frame the problem. Chapter 4 is an analysis of the data and how it relates to the model development. Chapter 5 details the actual model development and implementation. I present recommendations for model use, changes to UPT, and modifications to current policy as it relates to the new assignment process presented in Chapter 6. The final portion of the main document, Chapter 7, provides a framework for future and continued work on this subject. Finally, the appendices contain the various surveys, tables of results and skill definitions and relationships.

II. Past Research/Literature Review

Chapter Overview

This chapter will present previous research and introduce other efforts in the area of predictive performance. In preparing for this research, an extensive search of literature was conducted and several reviews of studies follow with ties to UPT and understanding the nature of student behavior as it relates to future outcomes in follow-on training.

The idea of using current behavior as a future predictor in the military is not new and dates back to pre-World War I. Many examples can be given showing research in the area of human behavior but will not presented here. What will be presented is the literature which has some direct or indirect tie to UPT and student performance.

Future Training Aircraft

In 2005, the RAND Corporation conducted a study "Assessing the Impact of Future Operations on Training Aircraft Requirements" (Ausink and others, 2005). The study was commissioned under Gen Donald Cook, then AETC Commander, to determine how the skills required to fly future Air Force aircraft might affect the decision to modify or replace the current fleet of training aircraft. RAND attempted to answer the question of what new skills, if any, should be taught in UPT to meet the challenges of modern war fighting machines.

The research was conducted through interviews with students and pilots in all stages of training and operational experience. With an open-ended questionnaire, they gathered feedback on skills the pilots felt were best learned in the operational aircraft, in the simulator, and/or in a training aircraft.

During the course of their study, RAND did answer many issues concerning future skills but the bottom line did not formalize any particular "skill sets." The study did provide several

generalized broad areas and provided the following recommendations for the future of UPT (Ausink and others, 2005:xv):

- "Collection, synthesis and prioritization of information in the cockpit" will have greater demands on the pilot
- Flying and controlling the aircraft must continue to be second nature
- Pilots will be challenged with greater responsibilities that are "focused on the management of information, sensors, and weapons"
- Proficiency at "layering technology solutions in the cockpit" must increase
- Pilot training must continue to teach the fundamentals of flying

The report raised serious questions with the F/A-22 and F-35 and the ability of a newly minted pilot max performing these advanced aircraft without any experience with an instructor in the aircraft. Although G Awareness is graded on many sorties throughout UPT, it is not a specifically identified skill. The T-38 is only capable of performing to 6 Gs while the F/A-22 is capable of sustaining 9 Gs - a significant increase. Since there are no plans for a 2-seat version of either platform, the pilot of these new aircraft *must* have an innate skill of G awareness and G loading. The ability of a student to recognize and perform while under G loading is just one example of a skill set which can be defined and should be used to assign students to a particular platform.

Conclusions from the report indicate the current fleet of training aircraft (T-1, T-6 and T-38C) are adequate for meeting the needs of training basic flying though. These aircraft are acceptable for introducing basic skills and replacement of the training aircraft should be based solely on economics and training needs.

"Concept: T-38C Enhanced Human Performance Training"

AETC/A3 is currently researching "skill-sets" from the perspective of human performance (Gillis, February 2006). Pilots appear to be doing all the right things under normal

conditions but there is concern about when a pilot faces adversity. By defining skill-sets, a focused effort can be directed toward training and preparing pilots for the future.

The study focused on Task Management and Situational Awareness skills. It was discovered there is a lack of "defined core competencies, training tasks and objectives related to decision making, situational awareness, [and] task management" (Gillis, 2006:8), thus identifying a key deficiency in the current UPT syllabus. In relation to follow-on aircraft upgrade training, a lack of skill definition may lead to a student having to complete training they are not fully equipped to accomplish and may require additional training or retraining at later stages in their upgrade.

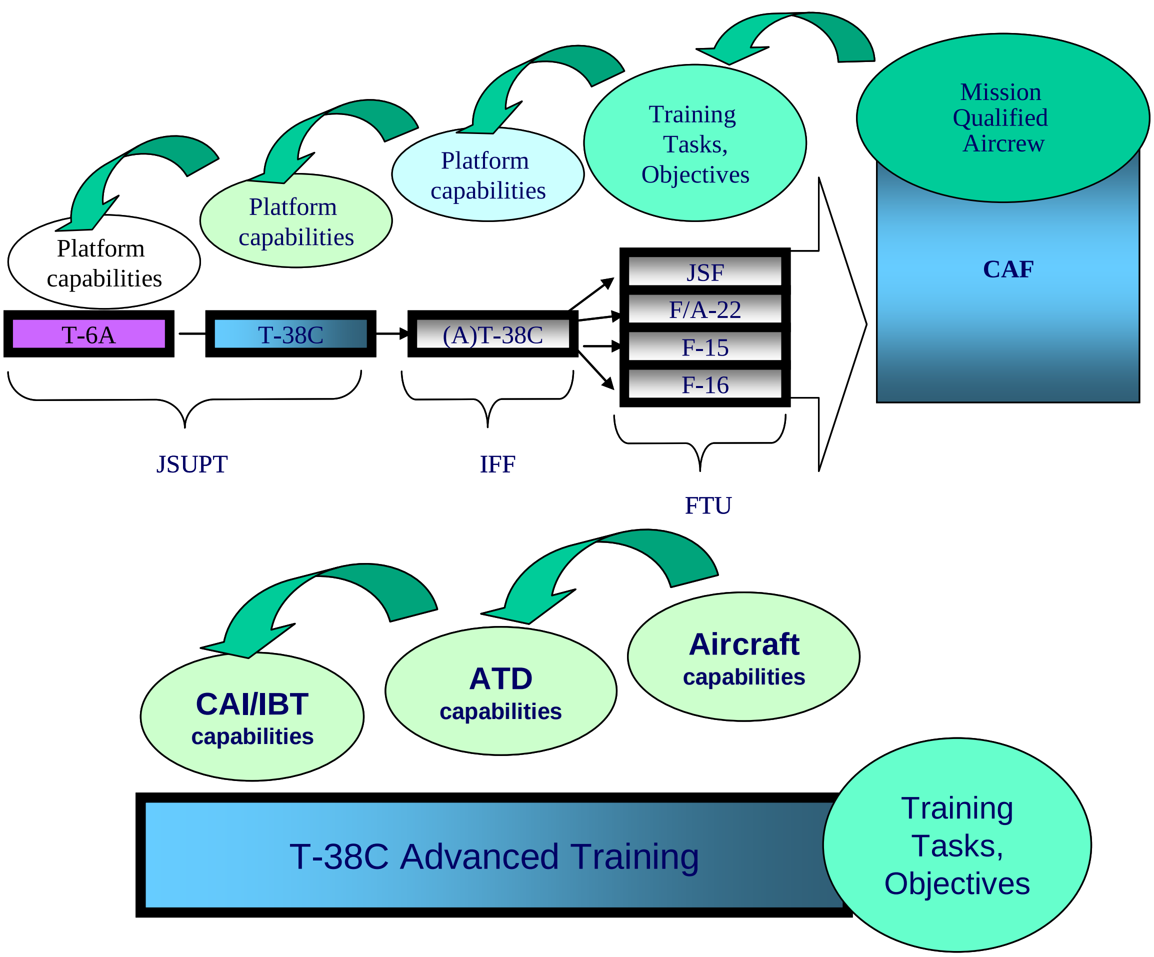


Figure 1 - Migrating Skill Requirements

In the past, maneuver or equipment-specific skills needed by the Combat Air Forces (CAF) have been brought back as a requirement (see Figure 1). This process does not necessarily exploit the strengths of a particular training platform or environment. By identifying a skill need, each platform can “explore and leverage individual training media” (Gillis, 2006:12).

The T-38C and T-6 offer opportunities to teach enhanced cockpit task management. The suggestion from the study was to expand UPT to utilize the new and upgraded training aircraft to their fullest potential which would mean a shift from the “traditional maneuver-centric” ideology to a more skills-based approach. A key point presented by Mr. Gillis concerning the new aircraft is “how we teach is of equal importance to what we teach” (Gillis, 2006: 9). The syllabus needs to be clear on the skill definitions and focused on the skills for the instructor to properly mold a student in the correct fashion.

The AETC study focused on two areas of pilot training and development. Since the initial stages of this research were conducted independently and parallel to AETC, the concept of skills based training and assignment is somewhat validated. This research s now part of the AETC effort and will expand on the skills-based approach to other facets of UPT.

“Building the Fighter Pilot”

In his paper “Building the Fighter Pilot: Developing Transferable Skill Sets” (Harman, June 2004), Capt Harman presents the current challenges in producing an F-16 pilot capable of handling the complex multi-role fighter mission. At the core, focusing on a specific mission limits the overall skill set training (Harmon, 2004:1). He contends that a solid training plan should be a balance encompassing skill sets required on all missions (Harman, 2004:1).

The UPT syllabus was created many years ago to prevent this "stove-pipe" warning presented by Capt Harman. However, the goal may be to produce a well-rounded pilot who has the ability to safely fly an aircraft, there is little or no emphasis on specific skills. The current syllabus details levels of performance on specific maneuvers and although there is thought behind the maneuvers and desired outcome, the actual skill relation is not presented.

A warning is also presented in the paper concerning the "eye-watering technological transformation" today's upgrading student faces (Harman, 2004:3). As stated previously, HOTAS, Helmet Mounted Sight and Fighter Data Link are just a few examples of technology in use today and little has changed in the training program over the years even though the student is now pushed to the limits their bodies can take. The question raised is, are the basic skills taught in UPT enough?

Capt Harman suggests developing "effects-based" training plan that builds on the basic skill sets taught in UPT and Introduction to Fighter Fundamentals (IFF) (Harman, 2004:5). He feels the basics of aircraft control, formation and basic communication skills must be second nature and are best taught in pilot training. Without specific feedback on these skill areas, the UPT instructor must subjectively determine if this goal is being met. Identifying and quantifying skills required in follow-on training is a requirement and should be part of the UPT syllabus.

T-38 Predictors Study

Prior to the RAND study on Training Aircraft Requirements, AETC Studies and Analysis Squadron completed a study to determine if there was a relationship between student performance in T-37 training (Phase II) and follow-on performance in T-38s (Phase III) (Hoss, November 2002). Although the original purpose was to determine if the best pilots were selected

to go to fighter training, the study intent became a determination if the best students in SUPT were selected for the T-38 track (fighter/bomber).

Among the assumptions AETC/SAS used, ENJJPT was deemed a "good 'lab' case" (Hoss, 2005:5) although ENJJPT is not a SUPT program. All ENNJPT Phase II students currently go on to T-38s in Phase III so the success/failure of the full range of abilities could be considered. AETC/SAS also assumed the final MASS value is the best indicator of a good pilot. One final assumption was no T-38 washout case was considered.

The bottom line result and recommendation from the study was the T-37 scores did predict the student performance in T-38s and only the top half of the T-37 performers should be sent to T-38s and eventually fighter aircraft. However, with the limits imposed by the assumptions, key data could have been overlooked. Many students do not "click" until mid-way through Phase III. By not considering the T-38 wash-out cases, a solid performer in T-37s may have done poorly eventually washing out in T-38s – an important data point.

Pilot Selection Model

Captain Ian Young explored the possibilities of using multivariate techniques to improve the Pilot Candidate Selection Model (PCSM). PCSM is a predictor based on three inputs as to the success or failure of a student in UPT (Young, March 2002). The concept is the Air Force can save money by not sending those students who are predicted to fail UPT based on known factors. The current PCSM uses the applicants Air Force Officer Qualification Test (AFOQT) scores, Basic Aptitude Test (BAT) score, and age to predict the outcome in UPT.

Using Discriminate Analysis, Artificial Neural Network structures, and Factor Analysis, Capt Young developed a model improving on the current PCSM. Through conditioning of the data, he created a model which better predicts the student success.

Multivariate analysis provides an opportunity to delve into a deeper mathematical modeling of predictive methods. However, the research conducted and presented here approaches the performance prediction of a student based on Decision Analysis and Value Focused Thinking concepts. Capt Young's model is a good example of additional research that can be accomplished to validate the concepts presented in this paper.

ENJJPT '08

The leadership at ENJJPT was tasked by the SC to examine the status of training as the T-38 upgrade is completed and the T-6 enters service at Sheppard in September of 2008, to determine if there are better training program alternatives and areas for efficiency increases and improvements. The original working group was chaired by Lt Col Eric Bogaards, Royal Netherlands Air Force, and Maj Bruce Dobbins, USAF.

The working group, with participating nation inputs, developed a plan to modify all phases of the ENJJPT training program. The conclusion was to "download flying skills and knowledge sets to teach the necessary skills earlier in flight training, exploit less expensive aircraft, [and use the] synergistic effects in follow-on training" (Dobbins, 2006:8). By modifying the flying training conducted at Sheppard, the goal is to improve the final product given to follow-on units with a greater focus on fighter skills. Although the plan improves many areas through exploitation of available technology and program flow, the original proposal kept the categorical focus intact.

Decision Analysis

Decision Analysis (DA) is a systematic, iterative process of evaluating and comparing alternatives. There are many tools associated with DA – Value Hierarchies, Sensitivity Analysis and Influence Diagrams. A key principle of DA, and modeling in general, is that these tools are

not necessarily meant to solve a problem but provide the decision maker a greater understanding of the problem. Often through the course of model development a greater understanding of not only the problem but possible alternatives becomes clearer.

A Value Hierarchy is a visual representation and organization of concepts and values representing an organization or problem. The higher the level in the hierarchy, the more general the objectives while lower levels become very detailed. For example, the top level of the hierarchy presented here is “Pilot Ability” (see Figure 7). At the lowest levels, specific skills such as “Heading Control” are represented (see Figure 8).

Sensitivity Analysis is probably the most important and useful tool in DA. It often answers the sometimes difficult question of “what if” after a model is developed and is a means of determining “what makes a difference in this decision” (Clemen and Riley, 2001:175). There are a variety of output results to assist a decision maker or model developer in determining how various inputs affect the outcome. Using the results, changes and improvements to the model can be made. Additionally, new alternatives and courses of action may be discovered.

Value Focused Thinking

Value Focused Thinking (VFT) is a specific application within DA. VFT is an approach to decision making by “first deciding what you want and then figuring out how to get it” (Keeney, 1992:4). The more traditional approach, alternative-based method, is to list available alternatives and select the best choice. By first considering what is important before considering the alternatives, a broader range of options may become available and the root problem can be better addressed.

Values, by definition, are ideas and principles used for evaluating the issue (Keeney, 1992:6). Shaping the values before consideration of any alternatives will prevent any bias

toward a particular, possibly favorite, alternative. Keeney terms this as “Constraint-Free Thinking.” The principle behind VFT is to evaluate desirable alternatives based on what is important to the decision maker.

A key benefit of using VFT is that the process helps better define a problem. A decision maker may feel they fully understand a problem or issue. However, after research begins, additional issues and problems may surface and potentially completely redefine the problem. By framing the problem and asking the questions about what values are important concerning the problem, the wider range of concerns are addressed prior to ever considering the possible alternatives.

The process for VFT is (Keeney, 1992:49):

1) Recognize a decision problem
2) Specify values
3) Create alternatives
4) Evaluate alternatives
5) Select an alternative

As part of specifying values, a comparative weighting is conducted. This weighting becomes a numeric percentage which will be used when comparing alternatives. Each alternative will be evaluated under each value, given a score, and the weighted scores are added together. The alternative with the highest score is the best choice.

Not all objectives are equal and may change over the range of possibilities. The value of an objective, and thus the score, may change as the input increases or decreases. If there is a constant increase or decrease in value as the objective input changes, the value function is

considered linear. Value functions can take on any form and most are non-linear. Piece-wise linear and exponential are two types of functions used in this research and will be presented later.

VFT Example

The following is simplified example of VFT. The idea presented does not relate to UPT or the assignment process but many of the same concepts will be used later in this research. For this example, a decision maker is faced with choosing a restaurant to visit for lunch. Before considering the restaurants available, the VFT process looks at defining what is important in this decision. Distance, food selection, and price may be three important values to the decision maker. There are potentially limitless possibilities but considering these three values will illustrate the concept. Our decision maker is a college student with limited funds and must walk to the restaurant so he values price and distance much higher than food selection. The following diagram shows the Value Hierarchy for this decision and shows the weightings our decision maker has attached to each objective.

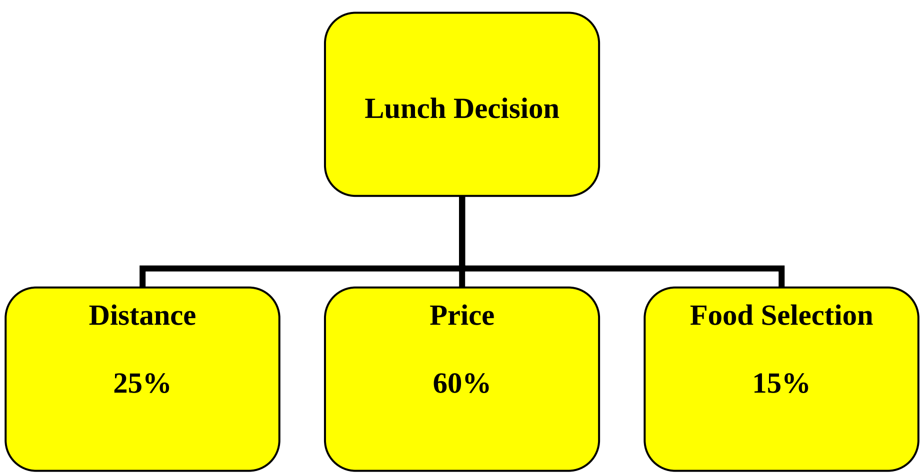


Figure 2 - VFT Example Value Hierarchy

Once each objective has been weighted, the individual objective must be considered. For distance, our decision maker must walk and is willing to walk up to 1 mile to eat. However, for distances beyond 1 mile, the decision maker, although willing to consider these restaurants, is

less receptive. Thus, the value for restaurants greater than 1 mile drops off. A piece-wise linear value function (see Figure 3) represents the decision makers feelings concerning distance.

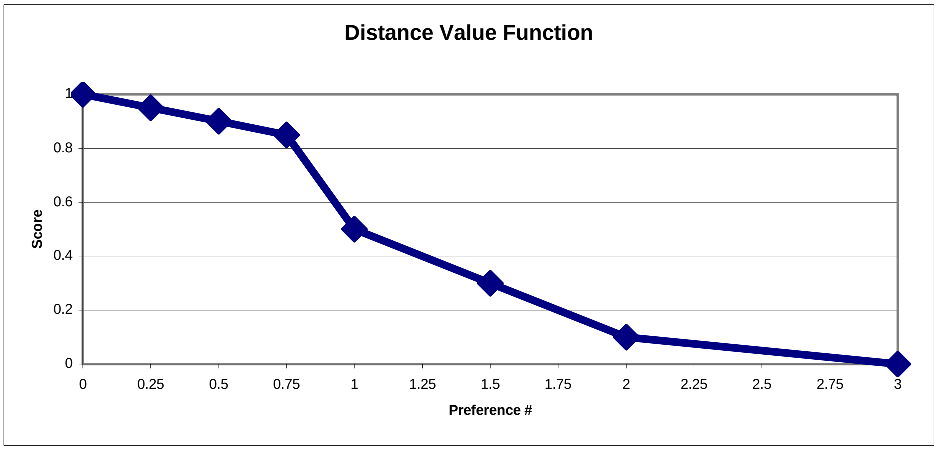


Figure 3 - VFT example Distance Piece-wise Linear Function

For price, our decision maker has concerns the greater the cost. In this case, a decreasing exponential function is used. Rho is the risk value the decision maker is willing to accept and mathematically determines the extent and direction of the exponential curve. A negative rho, in this case, indicates risk averse and produces a concave curve. A positive rho indicates risk seeking and results in a convex curve. The value of a decreasing exponential function is:

$$V(X_a) = \frac{1 - e^{\frac{-(Hi - X_a)}{\rho}}}{1 - e^{\frac{-(Hi - Low)}{\rho}}} \qquad (1)$$

$V(X_a) =$ returned value
$X_a =$ Objective input score
$\rho =$ rho = risk level

Note: for exp increasing functions, the expression $(Hi - X_a)$ is replaced by $(X_a - Low)$.

The value function for food selection is determined in a similar fashion by obtaining feedback from the decision maker. For our example, the food score will be considered equal for

the two competing restaurants. In all three objectives, the value of the function changes over the range of objective inputs and can be used to determine the overall alternative value. The next step is scoring of alternatives. For each restaurant, a score is calculated for distance, price, and food selection based on the value functions.

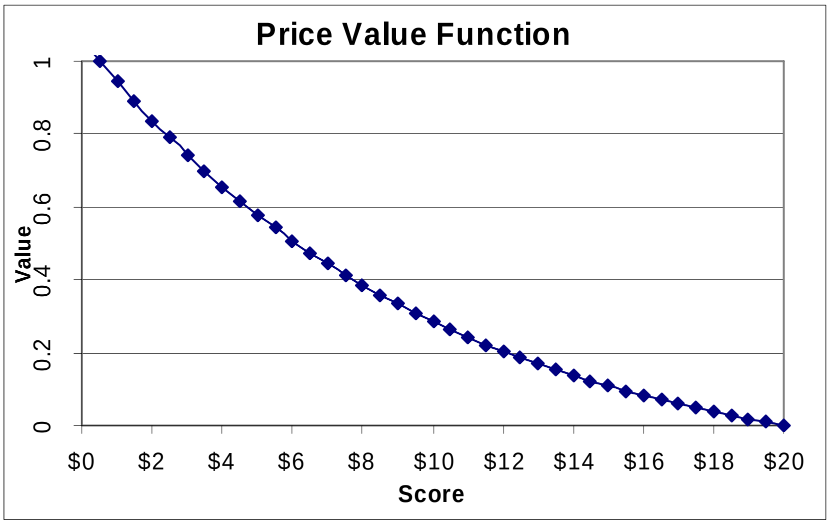


Figure 4 - VFT example Price Value Function

In our example, restaurant A is ½ mile away and the meal will cost $9. Restaurant B is 1.5 miles away but will only cost $4. From the above value functions, Restaurant A has scores of .9 and .4 while Restaurant B has scores of .3 and .65. Applying the value hierarchy weightings, restaurant A scores .9*.25 + .3*.6 = .405 and restaurant B scores .3*.25 + .65*.6 = .465. Although restaurant B is further away, the price of the meal weighs heavier and is the best alternative.

As stated previously, DA and VFT are tools to assist the decision maker. A choice may be suggested by the data but the decision maker still has input and can decide to go elsewhere. This is an important concept since no model can perfectly predict an eventual outcome. Expert opinion should consider and weigh the output carefully before making an ultimate decision.

III. Methodology/Data Collection

Overview

In April 05, the 90th FTS conducted a small working group examining the MASS and the relationships found in Table 1. The proceedings from this group became the base-line and seed for this research. This chapter will review the progression of obtaining and processing the initial data and present the follow-up data collection. The information for the model will be presented but the actual model development process and methodology will be presented in Chapter V.

The initial step in design and development started with identification of the core skills required to fly fighter aircraft through a survey instrument sent to all current fighter pilots in the CAF. These skills were then related to UPT instructed and evaluated events during a working group session held at Sheppard. Throughout the process, Decision Analysis techniques were used to create and modify a working mathematical model to assign students based on their strengths and the skills required to fly each aircraft type based on community inputs by current pilots flying the particular Major Weapons System (MWS). Finally, model validation was planned by using survey responses from student's instructors and relating these results to the student's UPT records. Unfortunately, approval to collect the student data was pending at the completion of this study leaving this validation phase for future work.

The entire UPT training philosophy was examined to determine if the current grading and scoring scheme is appropriately set-up for use in the proposed assignment model. As part of the review and model development, potential changes in the curriculum and syllabus were identified. These training and grading methodology recommendations will be presented in Chapter VI.

During the review of many of the skill areas, an assessment was made as to whether the skill is currently being instructed and properly evaluated in UPT. If an area was identified as

having no related UPT event, a recommendation is made on how best to develop the skill set. These recommendations are combined with the survey feedback to provide overall input to AETC and ENJJPT leadership.

Independent Review Board (IRB)/Survey Control Number (SCN)

Approval to conduct research and distribute surveys was submitted to and obtained from AFPC/DPSAS. Additionally, because human subjects were involved in the research process, approval from the Wright-State IRB was submitted and partially obtained. Additional approval was needed from the IRB and the base legal office concerning research into the students UPT records. Coordination and approval was also obtained from AETC/DOZ to access the students UPT records in the AETC master database. As stated above, this additional approval from the IRB was not obtained prior to completion of this report and additional validation will be a topic for future research.

Fighter Core Skills Survey (FCSS)

The basic survey (see Appendix A for the full survey) was developed from the perspective of querying fighter pilots on missions and skills needed to fly their particular MWS. The goal was to identify the core skills needed to fly fighter aircraft and if possible, tie specific skill sets to individual aircraft types. Although the "missions flown" information gathered was not critical to the overall research, it provided a frame of reference when relating skill sets. The pilots were also asked to reflect on their UPT experience and considering their current experience and required upgrade training, recommend changes for UPT to better prepare tomorrows students for fighter training. The initial survey was open ended and administered only to the fighter pilot population at AFIT.

The mission breakdown and skills questions resulted in a list of 23 skill areas which were then used for the larger, CAF-wide FCSS. Appendix A Screen 5 shows the skill areas the respondent was asked to rank order for each mission they flew in their MWS. These responses provided direct feedback on the skills required for each aircraft type.

For each of the 23 skill areas, the total number of responses within an aircraft group was compared. Using a relative weighting, a percentage score for the skill area was obtained. Since only nine specific skill areas are used in the aircraft assignment best-fit determination, these were the only skill areas considered from the FCSS.

Appendix A Screen 6 of the FCSS shows the classification of the original three broad areas. The respondent was asked to rate each broad skill area from 1 to 10. These responses were meant to define the weightings for the value functions used in the model. In theory, each individual fighter community would value the broad skill areas differently and their individual preferences could be applied to the model. The end model diverged from using the Basic, Instrument, and Mission areas. As a result, a follow-up survey was required to request opinions on the new skill areas.

Sheppard Surveys

In preparation for the FCSS, several smaller requests for information were sent to the instructor cadre at Sheppard (see Appendix B, Appendix C, and Appendix D). The objective was to identify and develop a value hierarchy and refine the problem statement. These surveys also provided an opportunity to begin relating UPT events to skill areas and lay the ground work for the ENJJPT MASS Working Group held in April 2006.

As with any model development, the short surveys became a tool for framing the issue and understanding in greater detail how the various aspects and pieces of information would

eventually be brought together. The surveys also provided the initial input for the value hierarchy weightings and comparison between skill sets.

Post ENJJPT Working Group, a follow-up survey (see Appendix E) was distributed among ENJJPT instructors and the AFIT fighter pilot population. This survey requested a weighting opinion on the revised skill set areas. As part of the survey, a clear definition was provided for each area to ensure the respondent clearly understood the composition of the skill set. A statistical analysis was conducted on the collected data and an average for each sub-skill area was obtained and used for weighting within the model. Specifically, all responses regardless of aircraft background were used in the General Skill sets and Other Skill sets. For the Aircraft Specific Skills, the results from all the respondents with a similar MWS background were compared and used.

ENJJPT MASS Working Group

The intention of the ENJJPT MASS Working Group was to refine the value hierarchy, obtain feedback on the research effort, and relate UPT events to the various skill areas. The group was comprised of representatives from every combat airframe and both training aircraft. Open discussion and direct input was encouraged and as a result of the group dialogue, the model focus changed.

The agenda found in Appendix I provided a framework for the group. After presenting the problem statement, a brainstorming session was used to gather inputs on what qualities make up a good pilot. The objective was to create a list of skills which could be used in the assignment model. From these qualitative skill lists, a relationship and link between skill areas and UPT events could then be formed.

There are varying opinions concerning the value of T-37/T-6 training versus T-38 training and whether check rides or long term performance is a better indicator of student performance. This dilemma was presented to the group for discussion. Using a 1000 poker chip technique, the group was asked to collectively determine the relationship between each of the four areas. This visual technique involves placing poker chips (or any other coin type object) in front of the decision maker. The group then moves chips from one pile to another, balancing the piles of chips until the proper relative groupings are found. The chips are counted and a percentage of the whole is determined for each area.

The final working group session involved another brainstorming session to relate UPT events to the previously obtained skill areas. The group members were asked to not only consider current UPT events but to also introduce new areas for instruction. Again, these results were qualitative but would provide a framework for assigning UPT graded events to a skill area during the model development.

Decision Analysis

The process of model development began with consolidation of the various survey, working group, and individual inputs. The value hierarchy was built, refined, and rebuilt based on the inputs. With the hierarchy framework developed, the weightings for each skill area were determined and recorded for use in the model.

To develop the weightings, a review of the missions and skill areas was conducted. Each time a skill was required to conduct a mission, it was counted toward the whole for the aircraft type. Once the total number of skill areas were tabulated for each aircraft, a relative value was calculated and a corresponding weight given. For each mission type, the respondent was asked to rank order the skills from 1 to 4 and provide any additional skill areas required for each

mission type. Because the responses did not have a relative weighting attached, only the raw numbers of each type of skill were used in the analysis.

Student Evaluation

To validate the accuracy of the model, student surveys were developed. The initial intent was to distribute these surveys to the instructor pilots of students currently completing fighter aircraft training. The instructors would be asked to rate the student's abilities in the skill areas used to define the assignment best fit in the model (see Appendix H). After receiving the responses, the UPT records of the same student would be obtained from the AETC database. For each of the nine sub-skill areas in the Aircraft Specific Skill set, the individual event grades would be recorded and a comparison between the actual UPT grades and RTU performance would be conducted. With the understanding that some students learn at different rates, a statistical evaluation would be completed and any modification or shifting of the model equations would be done. As stated previously, this phase was not completed prior to completion of this study pending approval from the legal office and IRB.

IV. Data Collection Results and Analysis

Summary

This chapter discusses the data results and the impact on the approach to the remainder of the project. The results from the FCSS are discussed with specifics concerning each aircraft community presented. Finally, the ENJJPT MASS Working Group ideas are presented.

General Results

The original concept was to break Pilot Ability into three broad skill areas and sub-classify required skills as shown in Figure 5. However, from the results of the FCSS and the ENJJPT MASS Working group, the broad areas began taking a similar shape to the existing assignment system using categorical performance. The survey results also indicated many common requirements with a small number of specific of skill sets varying between aircraft types. These two results forced a shift in how the skills were classified.

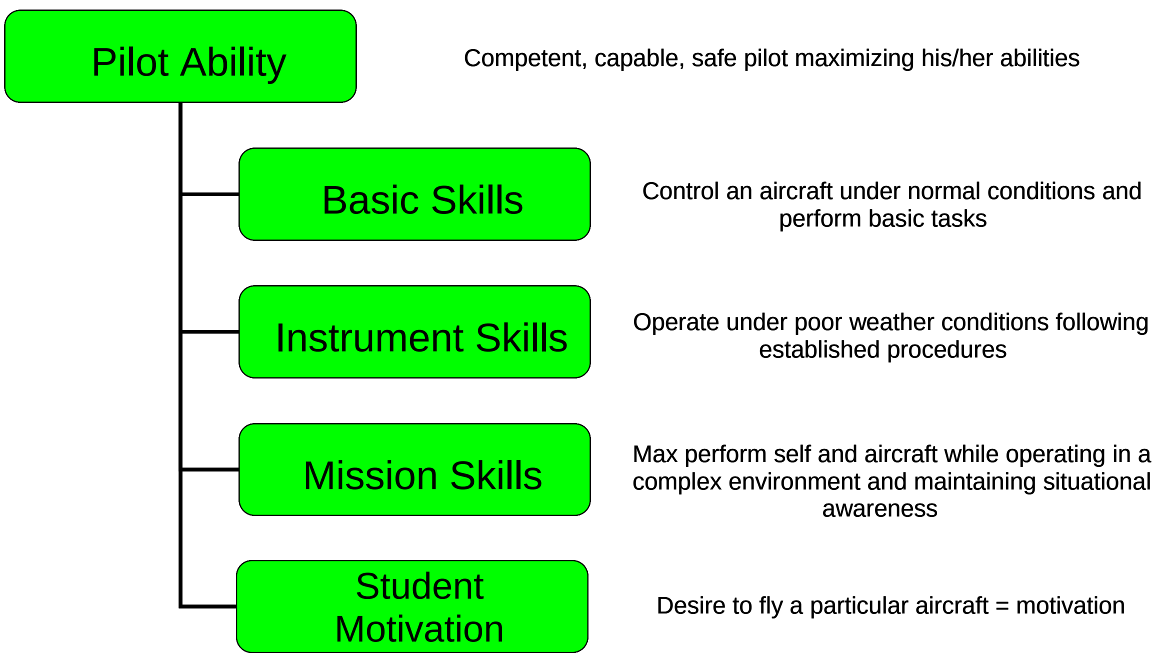


Figure 5- Original Broad Area Skills breakdown

FCSS responses

The FCSS was distributed to all of the CONUS fighter bases. Specific base information was neither requested nor is there any value added. However, the results did show a disproportionate amount of respondents in one fighter community and lack of responses from another. A limiting factor in the survey responses was the lack of information from training and bomber platforms. Although the survey was intended for the fighter community, information concerning these other platforms would have been beneficial and is an area for further research.

A total of 124 surveys were received from across AFIT, Sheppard and the CAF. Appendix F outlines the data collected. For each of the skill set areas, a breakdown by aircraft community was tabulated. Additionally, for each data point, the bottom rows indicate the average for all the surveys collected. The follow-up Updated Skills survey results are also included to complete the percentage breakdown. A 95% confidence interval for each statistical point is shown to indicate the potential error for the average in each category.

The table of Aircraft Specific Skills displays the response from each community concerning sub-skill areas. Since not all “required” skills are listed, the values were proposed to representatives from each community and refined with the FCSS responses used as the base-line. For example, the F-16 community had a 0% response for the Map Reading skill. This situation most likely resulted from the Map Reading skill not being a “top 4” skill for any particular mission but overall it is a necessary skill. Consulting the F-16 representative, this value was adjusted to approximately 5% to show a basic skill need but still honor the community desire for this skill to not be a major deciding factor in a student being assigned to the F-16.

Broad Area Comparisons

The initial hypothesis was the broad skill areas for each aircraft type would differ significantly enough to be useful in the assignment model. This became the first area of analysis from the FCSS. Each broad area was compared between aircraft types utilizing an ANOVA using the MINITAB statistical program (see Figure 6). For the Basic and Instrument broad area skills, the resultant P-value indicated the means did not vary significantly between aircraft types. With the Mission skills, the P-value was 0.000 indicating a difference at greater than a 99% level of significance. However, with the T-38 not having dedicated "mission" skills, the data from these respondents skewed the results and as such, was removed. When the T-38 data was removed, the P-value increased to 0.202 which was a better indicator of no statistical difference between any of the aircraft.

One-way ANOVA: Basic Skills versus A/C

```
Source   DF      SS    MS     F      P
A/C       5    3.85  0.77  0.64  0.669
Error   114  137.14  1.20
Total   119  140.99

S = 1.097   R-Sq = 2.73%   R-Sq(adj) = 0.00%

          Individual 95% CIs For Mean Based on Pooled StDev
Level   N   Mean  StDev  ---------+---------+---------+---------+
A-10    2  9.000  1.414      (--------------*--------------)
F-15C  65  9.062  1.144                   (--*-)
F-15E  15  8.667  1.047            (-----*----)
F-16   19  9.053  1.026                 (----*----)
F-22   16  9.188  0.750                 (-----*----)
T-38    3  8.333  2.082  (-----------*-----------)
                         ---------+---------+---------+---------+
                                8.0       9.0      10.0
11.0
```

One-way ANOVA: Instrument Skills versus A/C

```
Source   DF      SS    MS     F      P
A/C       5   17.78  3.56  0.98  0.430
Error   114  411.81  3.61
Total   119  429.59

S = 1.901   R-Sq = 4.14%   R-Sq(adj) = 0.00%

          Individual 95% CIs For Mean Based on Pooled StDev
Level   N   Mean  StDev  --+---------+---------+---------+-------
A-10    2  8.500  0.707   (----------------*----------------)
F-15C  65  7.508  2.070           (--*--)
F-15E  15  6.733  1.580  (------*-----)
F-16   19  7.842  1.893           (----*-----)
F-22   16  7.938  1.482           (-----*-----)
T-38    3  8.333  1.528     (--------------*-------------)
                         --+---------+---------+---------+-------
                            6.0       7.5       9.0      10.5
```

One-way ANOVA: Mission Skills versus A/C

```
Source   DF       SS     MS      F      P
A/C       5   34.862  6.972  11.64  0.000
Error   114   68.305  0.599
Total   119  103.167

S = 0.7741   R-Sq = 33.79%   R-Sq(adj) = 30.89%

          Individual 95% CIs For Mean Based on Pooled StDev
Level   N    Mean  StDev  ----+---------+---------+---------+-----
A-10    2  10.000  0.000                        (-------*------)
F-15C  65   9.708  0.605                              (-*)
F-15E  15   9.667  0.488                             (-*--)
F-16   19   9.368  0.895                           (-*--)
F-22   16   9.813  0.403                              (-*--)
T-38    3   6.333  3.512  (-----*-----)
                          ----+---------+---------+---------+-----
                              6.0       7.5       9.0      10.5
```

One-way ANOVA: Mission Skills versus A/C (T-38 removed)

```
Source   DF      SS     MS     F      P
A/C       4   2.362  0.590  1.52  0.202
Error   112  43.638  0.390
Total   116  46.000

S = 0.6242   R-Sq = 5.13%   R-Sq(adj) = 1.75%

          Individual 95% CIs For Mean Based on Pooled StDev
Level   N    Mean  StDev  --------+---------+---------+---------+-
A-10    2  10.000  0.000   (----------------*----------------)
F-15C  65   9.708  0.605           (--*--)
F-15E  15   9.667  0.488       (-----*------)
F-16   19   9.368  0.895  (----*-----)
F-22   16   9.813  0.403          (-----*-----)
                          --------+---------+---------+---------+-
                                9.50     10.00     10.50
```

Figure 6 - ANOVA results

Based on this result and continuing with a "skills" based approach, a new hierarchy was developed and is shown in Figure 7. Three broad areas are considered: General Skills, Aircraft Specific Skills, and Other Skills. The General Skills are the foundation for which all pilots, fighter or otherwise, must have solid abilities. This foundation can be built upon throughout the remainder of pilot training and follow-on fighter training. The Specific Skills set may be applicable to each aircraft but carry a different weight for each community. The Other Skills are those higher level or less tangible skills which bring a pilot to the next level of competence.

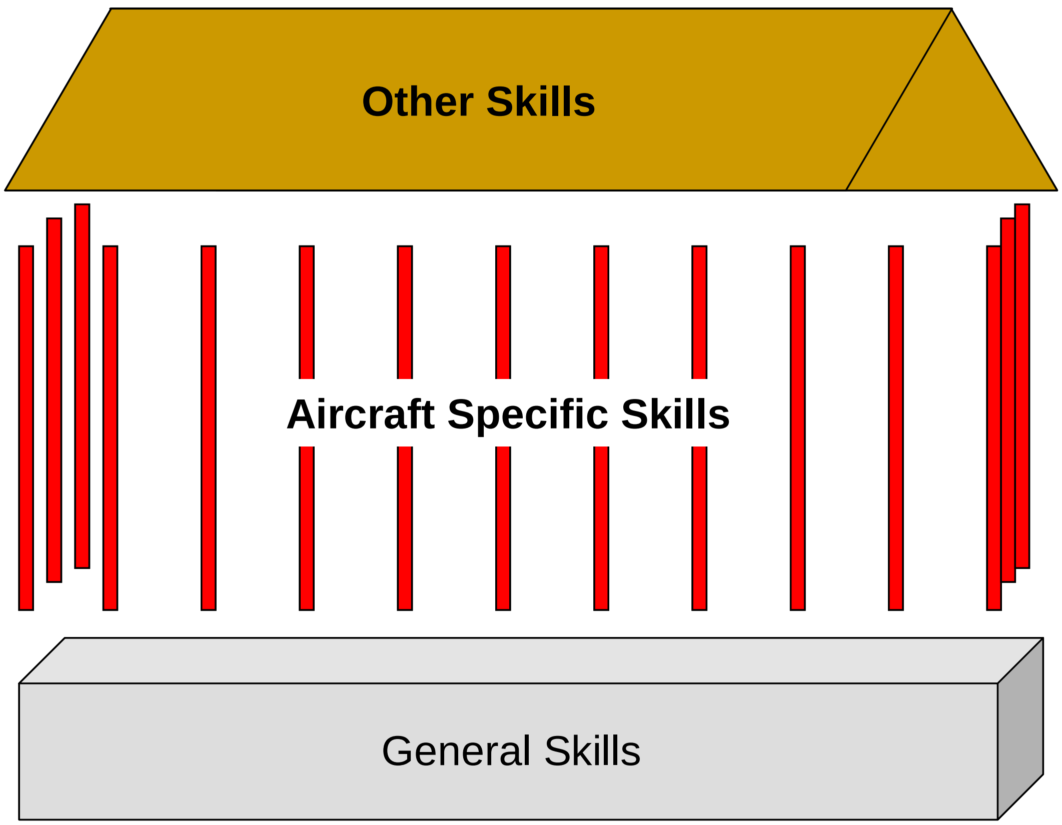


Figure 7 - Broad Area Skills sets

The FCSS results indicated three major common areas – SA, Multi-Tasking, and Sensor Operations. For each individual aircraft type, three to four areas stood out as possible specific skills. From this, nine skill areas were identified and were classified as the Aircraft Specific

Skills set. Each of the broad areas has been broken into sub-skill areas and these skills determine the overall pilot ability and can be linked to instructed UPT events.

Figure 8 shows the developed hierarchy. The functional objective (top of the hierarchy) is the Pilot Ability. Tier 1 shows the three broad areas and tier 2 the subset skill areas.

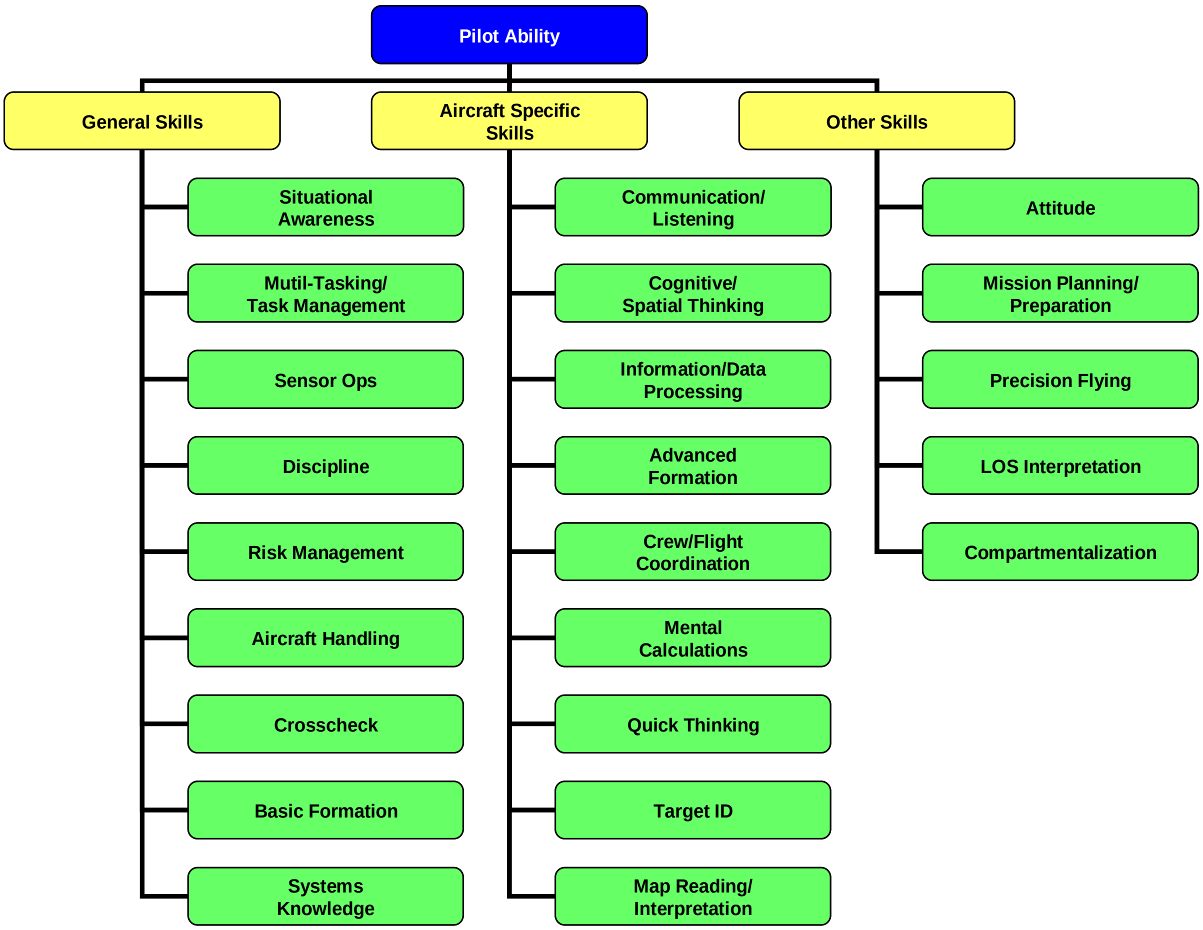


Figure 8 – Skill Subset breakdown

For assignment purposes and determining the best fit aircraft then, the Aircraft Specific Skills are the key factors in the model. For example, the Target Identification (TGT ID) skill is ranked very high among bomb dropping communities (A-10, F-15E, F-16) while platforms geared more to an air-to-air role do not have much need for such a skill. If a student is strong in TGT ID, his/her best fit aircraft should be a bomb dropping platform. For each student all skill

areas are considered for overall ranking between students and to differentiate closely skilled students when a limited number of aircraft are available.

Sortie Type Comparison

For each category of training, there are four sortie classifications a student can fly. A maneuver flown within a skill area is further broken into Phase II (T-6/T-37) and Phase III (T-38) and subdivided between daily rides and check rides. Figure 9 shows the breakdown between the event classifications. The local weightings shown are a comparison of values between elements in a branch at the same tier level. The global weightings are a relative weighting between all measurable values in the hierarchy on the same tier.

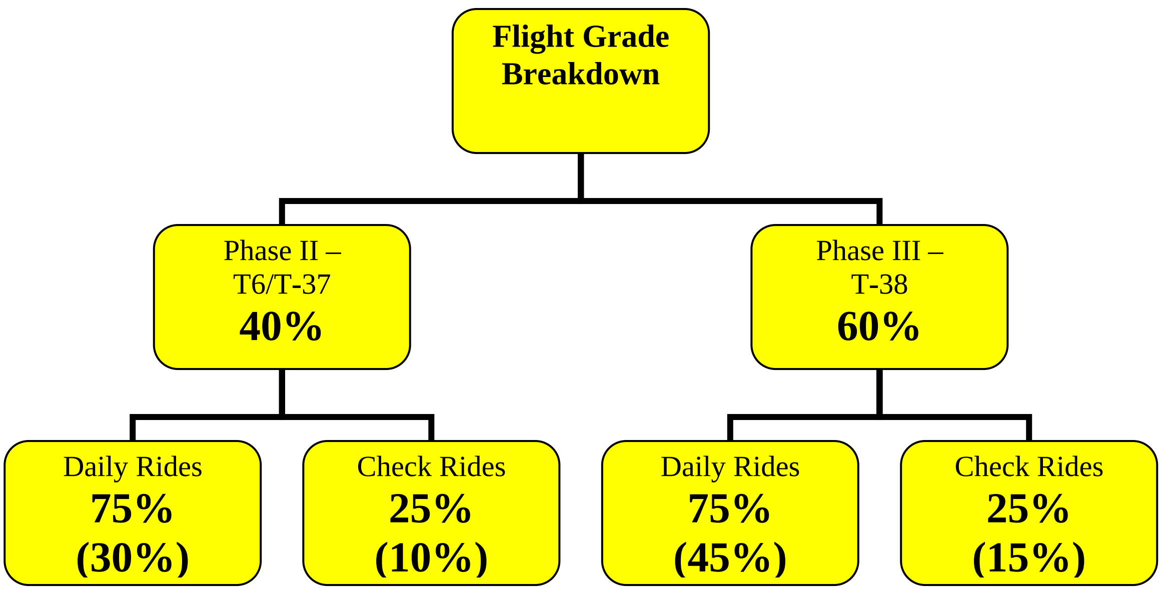


Figure 9 – Sortie Classification breakdown
Local weighting
(global weighting)

The check ride in each category of training is an important event and determination of student progression. The intent is to place a student under higher than normal stress and evaluate if the student has achieved the desired training goals for the particular point in the program. Currently, the check ride scores are weighted much higher than the daily scores (see Table 1).

However, feedback obtained from the CAF and the instructors from the ENJJPT Working Group indicated the emphasis should be placed on the long run daily performance of a student. The result was a shift to heavier daily ride weightings and since ENJJPT is a fighter focused program, the higher performance phase of T-38 training was favored over Phase II performance.

Student Preference

A final portion of the assignment equation is the student's aircraft preference and desires. A student is partially, if not completely, motivated by the idea of flying a particular aircraft and performing a certain mission. Adding a value in the model to represent this preference acknowledges this motivation.

From survey and working group feedback, it was seen that a student in the top 1/3 of his/her skill group should not have their assignment swayed by performance but more by aircraft preference. To achieve this affect, each of the skill value functions is designed to have the highest value returned at 2/3 of the overall score potential. Any score above the 2/3 point, the student will receive no additional points in the particular skill set. Again, validation with the actual student data may result in adjustments to these curves and changes to this 1/3-2/3 plan.

Value Functions

The value functions for the skill areas and student preference were obtained through interviews and opinions obtained from both CAF pilots and training instructors. The scores are somewhat arbitrary since the complete database table has not been completed. However, the concepts are the same regardless of the scores used and are easily modified in the model.

All three of the broad skill sets (General - Figure 10, Other - Figure 11, and Specific - Figure 12) are represented by linear functions for the first 2/3 of the score points and then by a constant value of 1 for the top 1/3. When combined with the Student Preference value

(Figure 13), a student in the top 1/3 of the skill area will have the Student Preference as the leading factor in the best fit equation. A linear function was primary used as a base-line case due to its simplicity and clarity to understand the function. The "Value Breakdown" page of the Excel spreadsheet model has the capability to input parameters for an increasing exponential value function. During validation, if it is determined the General and Other Skill areas do vary between aircraft types, the Specific Skills value function can be modified to continue in an increasing fashion for the top 1/3 of the skill score, while General and Other remain the same, acknowledging the Specific Skills do play a greater role in the ability of the student.

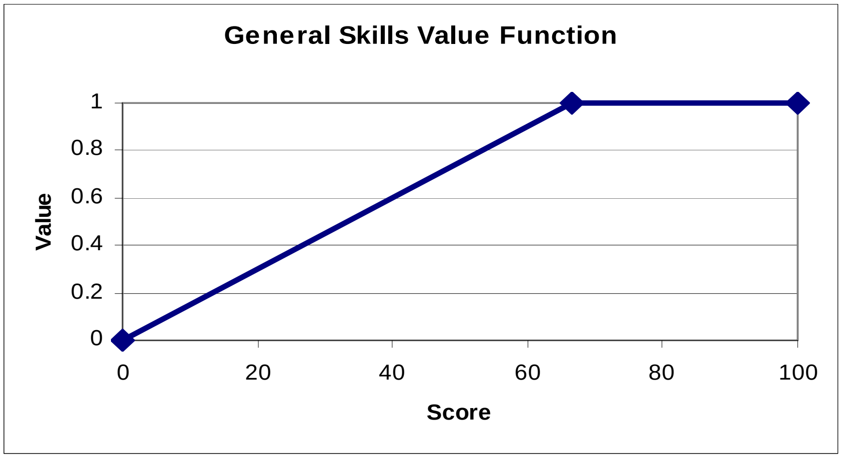


Figure 10 - General Skills Value Function

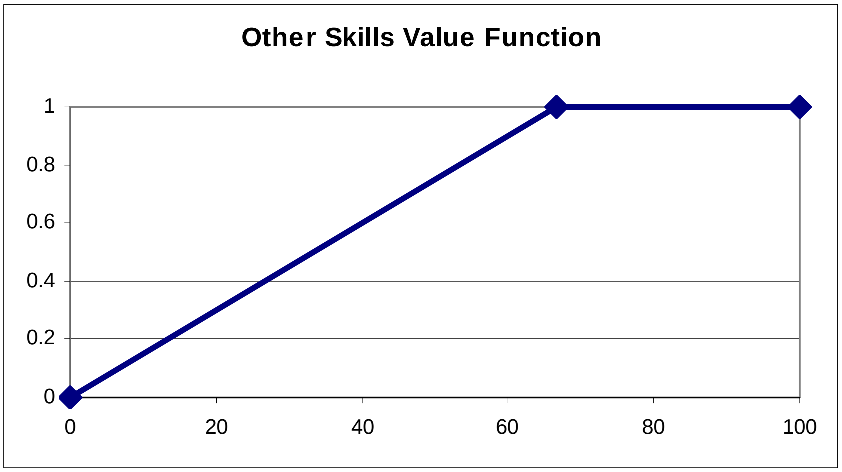


Figure 11 - Other Skills Value Function

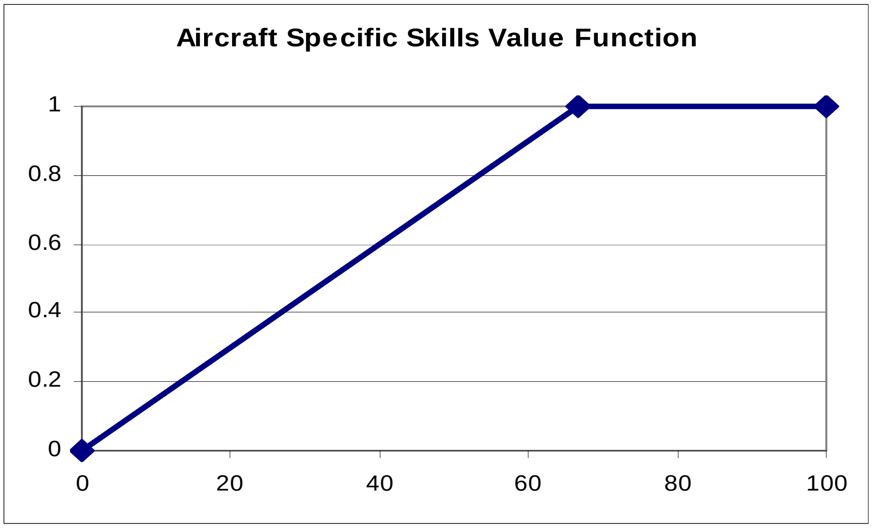


Figure 12 - Specific Skills Value Function

With eight distinct points representing the student's aircraft preference, a piece-wise linear function is the best depiction of value. As can be seen in Figure 13, only a slight decrease exists for the first three aircraft choices after which a sharp decline in value occurs. A student is motivated by being assigned to his/her top three choices and de-motivated by any other choice.

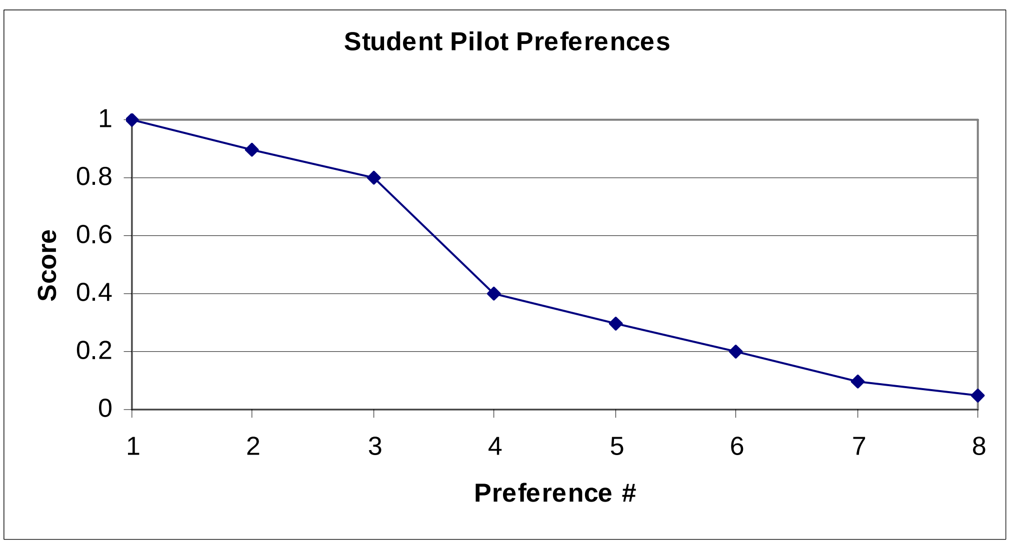


Figure 13 - Student Preference Value Function

Skills Breakdown

From the follow-up survey, a breakdown of each broad skill area was calculated. For General and Other Skills sets, the data was averaged and a 95% confidence interval (half-width shown in Table 2 and Table 3) was calculated. Table 2 and Table 3 show the data results. Figure 14 and Figure 15 graphically depict the percentage breakdowns for the two broad areas.

Table 2 - General Skills breakdown data results

General Skills	SA	Multi-Task	Sensor Ops	Discipline	Risk Mgmt	A/C Handling	Crosscheck	Basic Form	Sys GK
Avg:	20.26%	21.68%	10.15%	10.40%	8.20%	9.99%	9.19%	3.65%	6.49%
SD:	4.73%	12.05%	9.16%	6.56%	6.88%	8.44%	2.94%	2.74%	1.49%
CI:	0.02%	0.04%	0.04%	0.05%	0.07%	0.11%	0.02%	0.06%	0.02%

Table 3 – Other Skills breakdown data results

Other Skills	Prec Fly	LOS Interp	Compart	Attitude	MSN Prep
Avg:	1.67%	1.15%	0.42%	1.28%	0.85%
SD:	0.97%	1.92%	0.52%		
CI:	0.02%	0.04%	0.01%		

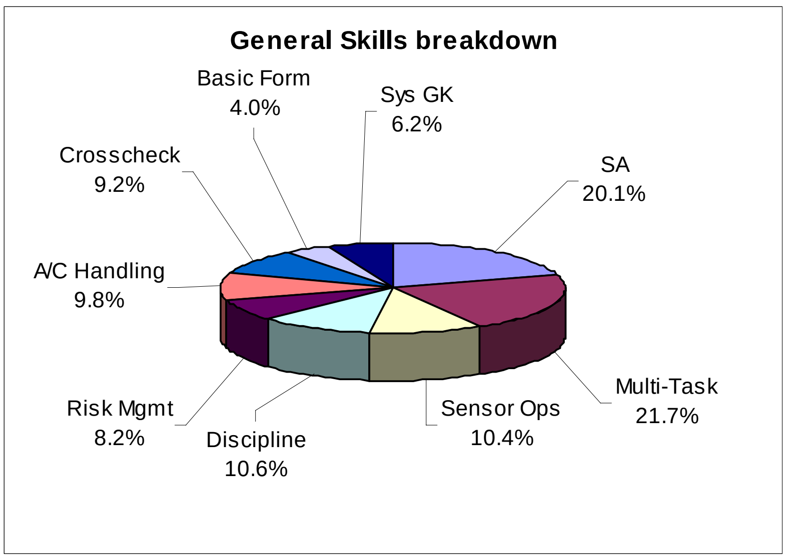


Figure 14 - General Skills Breakdown

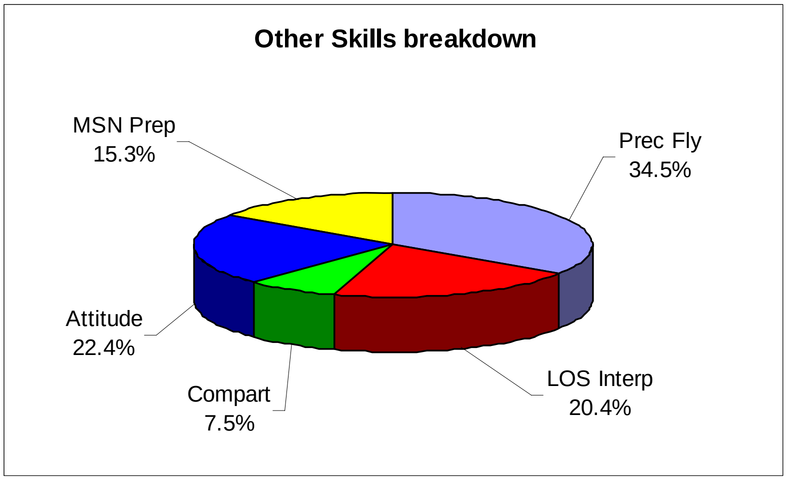


Figure 15 - Other Skills Breakdown

The FCSS did not query opinions concerning "Attitude" and "Mission Prep". To prevent incorrect weightings from a misperception and misunderstanding in the Other Skills set, only the data from the follow-up Updated Skills survey was used. For this last survey, the categories were clearly defined and potential errors associated with a smaller data set do not outweigh the errors associated with missing data from the FCSS.

For the Specific Skills set, the data from each aircraft type was used to develop the matrix found in Table 4. To augment the aircraft communities with small sample return, representatives where polled to provide additional input on the various weightings.

Table 4 - Specific Skills breakdown by aircraft

	A-10	F-15C	F-15E	F-16	F-22	T-37/T-6	T-38	Bomber
Communication/Listening	12.5%	20.3%	16.9%	20.2%	8.2%	20.0%	17.0%	16.0%
Cognitive/Spatial Thinking	8.3%	15.0%	15.4%	14.8%	23.4%	10.0%	12.0%	8.0%
Information/Data Processing	21.3%	13.8%	11.8%	12.1%	38.3%	10.0%	17.0%	13.0%
Advanced Formation	1.7%	15.3%	8.1%	10.8%	0.0%	5.0%	16.0%	17.0%
Crew/Flight Coordination	7.9%	7.0%	18.4%	8.2%	2.4%	20.0%	8.0%	17.0%
Mental Calculations	8.8%	7.6%	2.9%	7.9%	8.2%	10.0%	6.0%	4.0%
Quick Thinking	10.0%	10.7%	5.1%	9.2%	18.5%	5.0%	12.0%	4.0%
Target ID	24.5%	5.7%	19.1%	14.0%	0.0%	5.0%	6.0%	8.0%
Map Reading/Interpretation	5.0%	4.6%	2.2%	2.8%	1.0%	15.0%	6.0%	13.0%

Since the focus of this research effort was on fighter aircraft assignments from ENJJPT, the FCSS was geared toward fighter aircraft communities. Because of this focus, limited

responses were obtained from the trainer and bomber communities. To properly convey the trainer and bomber aircraft skill needs, further results need to be obtained from these communities. The F-15C, F-15E, F-16 and F-22 sample sizes were sufficiently large to provide statistically accurate data with one exception. As stated before, the F-16 Map Reading category was changed from 0% to 4.8% and the remaining skill areas reduced by a proportional amount.

Sub-Skills score development

Calculating the actual score to be input into the model involves accessing a vast amount of data from the grades input by the instructors over the course of pilot training for each student. Conducted manually, this is a labor intensive effort. Currently, the TIMS system provides data output based on tables developed to support the MASS and is automatically extracted whenever a "run" is requested.

Table 5 - Sub-skills tabulation

	Low	High	Factor	Shift
Communication/Listening	-10	25	0.0286	10
Cognitive/Spatial Thinking	0	30	0.0333	0
Information/Data Processing	0	10	0.1000	0
Advanced Formation	-15	50	0.0154	15
Crew/Flight Coordination	0	15	0.0667	0
Mental Calculations	0	20	0.0500	0
Quick Thinking	0	20	0.0500	0
Target ID	0	20	0.0500	0
Map Reading/Interpretation	0	20	0.0500	0

The concept behind the scoring is to determine the deviation from Maneuver Information File (MIF) for each grade, average the deviation, and assign a point value. Using DA principles, the data must first be conditioned. Table 5 is an example of how the data would need to be conditioned for the database table. For each skill area a low and high deviation can be calculated. For the low value, the lowest possible grades while still achieving progression in accordance with the current syllabus are assumed. For the high value, the opposite is assumed. Both extremes are highly unlikely but do represent the extremes. Since it is possible to achieve

negative scores, the “shift” value establishes “0” as the standard reference point. The “factor” normalizes the raw scores so each skill area has a relative score from 0 to 1.

Sensitivity Analysis

As part of the data analysis, the areas of the Specific Skills set were compared between aircraft types. A table was developed within the model to show the relative values between aircraft types for a given data set. Figure 16 shows an example of this relationship.

`	Comm/ Listening	Cog Think/ Spatial Think	Info/Data Processing	Adv Form	Crew/Flt Coord	Mental Calc	Quick Thinking	Target ID	Map Reading/ Interpretation
Raw Score:	10	5	10	7	3	4	5	4	10
	A-10	**F-15C**	**F-15E**	**F-16**	**F-22**	**T-6/T-37**	**T-38**	**Bomber**	
Specific A/C Score:	43.642	42.088	37.242	39.485	54.131	40.538	44.130	42.530	

Top 3 Best Fit:	**#1**	**#2**	**#3**
	F-22	T-38	A-10
	54.131	44.130	43.642

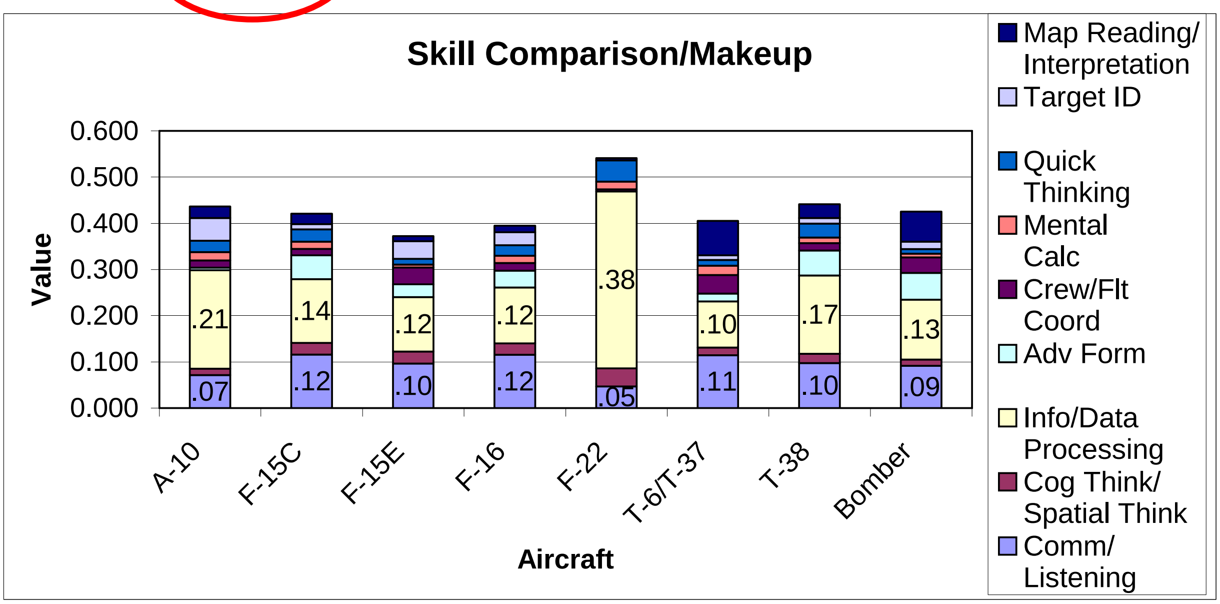


Figure 16 - Skill Comparison Analysis #1

In this example, Information/Data Processing can be seen as the most dominate skill, followed by Communication/Listening. To further understand the relationship, the particular skill values have been added. By incrementally changing Info/Data Processing, it can be seen

that once the value reaches 5.4, the best fit aircraft changes to a Bomber (Figure 17). Each of the nine skill areas can be assessed in this manner.

When two or more aircraft have an identical score, the default will be the furthest aircraft to the right. However, at one decimal place for the score values, there are $1x10^{18}$ possible combinations meaning the likelihood of an identical match is extremely low. With the addition of the student preference, the probability of a match is even lower. However, if an identical match occurred, the decision maker would still have the ability to choose the assignment.

Specific Skills	Comm/ Listening	Cog Think/ Spatial Think	Info/Data Processing	Adv Form	Crew/Flt Coord	Mental Calc	Quick Thinking	Target ID	Map Reading/ Interpretation
Raw Score:	10	5	5.4	7	3	4	5	4	10

	A-10	F-15C	F-15E	F-16	F-22	T-6/T-37	T-38	Bomber
Specific A/C Score:	33.844	35.740	31.814	33.919	36.513	35.938	36.310	36.550

Top3 Besat Fit:	#1	#2	#3
	Bomber	F-22	T-38
	36.550	36.513	36.310

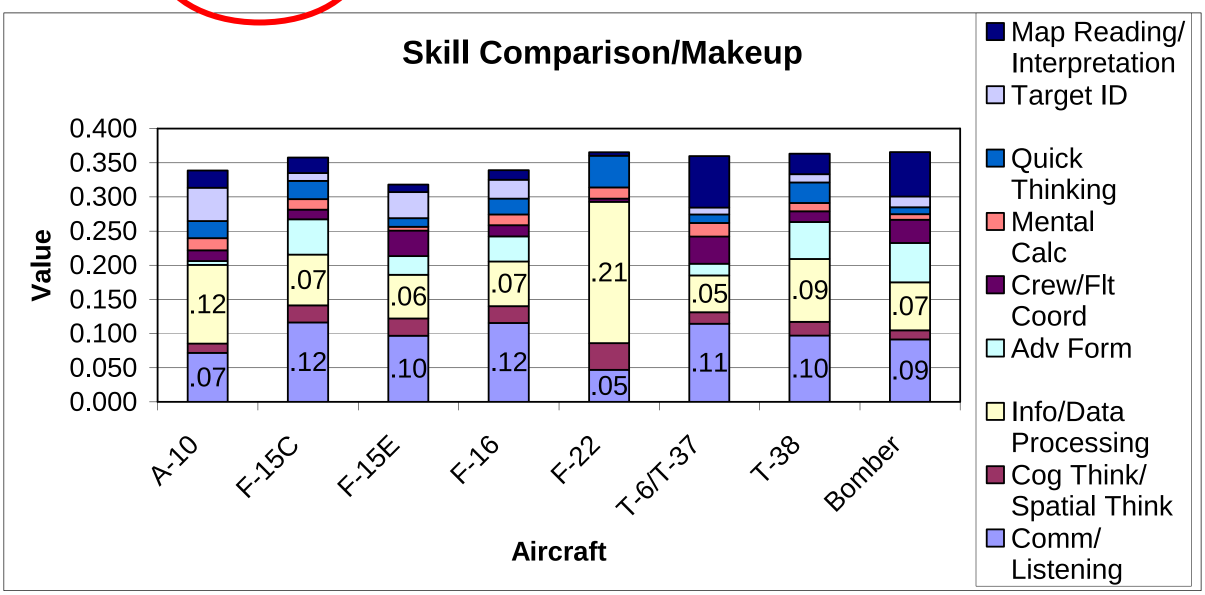


Figure 17 - Skill Comparison Analysis #2

Relating UPT events to Skills

A key objective of the ENJJPT MASS Working Group was to develop a list of relationships between events taught in UPT (both current and possibly future) and the Skill areas

and sets developed from the FCSS and other surveys. Appendix G lists each of the Broad Skill sets with the accompanying sub-skill areas. Using a brainstorming session during the ENJJPT MASS Working Group, each skill area was tied to one or more UPT events which are listed in Appendix G.

In addition, the group provided feedback on the need for “narrow” definitions. After each skill and UPT event, a definition, objective, or question is stated to help define the event and the relationship to the particular skill. The current syllabus provides Phase Training Standards (PTS) and general definitions but because the syllabus is not focused toward skill sets, the skill areas need proper explanations.

Table 6 – PTS Excerpt from ENJJPT Syllabus (May 2004)

	b. Enroute (1) TACAN course intercepts inbound, outbound, immediately after station passage, and maintain course. (2) TACAN arc-to-radial intercepts, radial-to-arc intercepts, and maintain arcs. (3) Groundspeed check. (4) TACAN fix-to-fix navigation. (5) Maintain enroute time and fuel data. (6) Perform enroute descent. (7) Perform TACAN holding.	a. Flight mission profile requiring accomplishment of these maneuvers. b. FLIP departure, enroute, and arrival publications available in aircraft. c. Predetermined or directed route of flight to be flown. d. Predetermined or directed target fix. e. AF Form 70. f. Navigation computer. g. Day or night. *Special* 1. Night navigation techniques are practiced 2. Prescribed heading and level-off altitude. 3. Day or night. 4. Holding pattern as described by controller or *FLIP* document. 5. Given an EFC, EAC, or an ETA.	a. Maintains course ±5° or a valid intercept. b. Maintains arc ±2 NM or a valid intercept. c. Obtain required data and calculate groundspeed. Use information to update inflight planning. d. Initiate necessary corrections to target for fix-to-fix, and arrive within 3 NM radius. e. As soon as practicable after passing each enroute fix, can utilize actual time of arrival at the fix, actual fuel remaining at the fix, and estimated time of arrival for next fix for updating inflight planning. f. Able to update precomputed fuel and time, as necessary. g. Plan and execute and enroute descent which considers fuel efficiency and results in a smooth transition of final approach. h. Performs entry procedures and maintains designated pattern IAW AFM 11-217 and *Flight Manual* procedures.

As an example, Table 6 shows an excerpt of the PTS from the ENJJPT Syllabus. The first column is the “skill” area, the second the conditions under which the student will perform the maneuver, and the third, the standard the student must achieve. For a “fix-to-fix” maneuver,

the only criterion is the student must "initiate necessary corrections to target for fix-to-fix, and arrive within 3 NM radius" (ENJJPT Syllabus, May:68). Under the skills-based construct, the instructor presents the student with the concept of using the 60-to-1 rule, the rule of 5's, etc. to give the tools and skills behind the fix-to-fix maneuver. The grade given to the student is a reflection of his/her ability to adapt to this skill and properly apply the skill to the maneuver. The definitions as shown in Appendix G are:

Table 7 - Skill definition excerpts

Aircraft Specific	Mental Calculations	Fix-to-fix	Applies proper mental calculations to achieve a successful fix-to-fix
Aircraft Specific	Information/Data Processing	Fix-to-fix	Incorporates all available information to fly a proper fix-to-fix

Bottom Line

When a student graduates from pilot training, they need to have a defined skill set the follow-on training units can use and further develop. The data collected shows there is a commonality among many skills but nine separate skills vary among the aircraft types. The feedback received from the field overwhelming states every graduate of pilot training needs to posses a solid, robust foundation of basic skills. These skills are encompassed in the General Skills set in this model. For the individual communities, a solid framework of specialized or Specific Skills needs to exist. This framework is where the IFF and the RTUs focus their energies further developing the newly minted pilot. Finally, the more esoteric or higher skills complete the pilot. Although desired, these skills are not as crucial to the initial development of a pilot.

V. Model Development and Analysis

Overview

This chapter presents the development and use of the assignment model. The intent behind the model was to provide a simple, user friendly application to assist the decision maker in determining future placement of a UPT class of students. The goal was to provide a model utilizing a desktop PC with standard software available to all USAF users. For this application, Microsoft Excel was used as the base spreadsheet program.

Model Input

Figure 18 shows the input page for Student Preference. For each student, the eight choices are rank ordered and put into the spreadsheet. The model contains a search function for an aircraft name and will return a "0" score if an aircraft is not listed in the preference. To prevent a student from having an undue advantage by not listing an "unwanted" aircraft, all eight blocks should be completed unless the decision maker is aware a particular aircraft will not be available (eg F-22 and later, the F-15C).

		Choice/Preference		Note: Although preferences are not case sensity, the syntax must match X2 to AE2 cells (i.e. "A-10" can not be entered as "a10")					
		1	2	3	4	5	6	7	8
Student ID	**Student Name**								
1	A	F-15C	F-15E	F-16	A-10	F-22	T-6/T-37	T-38	Bomber
2	B	F-15E	F-15E	F-16	F-15C	F-22	T-6/T-37	T-38	Bomber
3	C	Bomber	F-15C	F-16	F-15E	A-10	F-22	T-6/T-37	T-38
4									
5									

Figure 18 - Student Preference input page

Figure 19, Figure 20, and Figure 21 show the input pages for entering the student skill score data. The actual values for each skill area are obtained from TIMS and the combined score input in the model. The low and hi values are the range of possible raw scores.

	General Skills Raw Scores:								
	Note: If a cell is blank, a "0" is assumed which may not be the low value for the skill area and will result in a skills score.								
	SA	Multi-Tasking	Sensor Ops	Discipline	Risk Management	Aircraft Handling	Crosscheck	Basic Formation	System Knowledge
Low:	-10	0	0	0	-15	0	0	-10	0
Hi:	25	30	10	50	15	25	50	20	20
Stud 1	-10	0	0	0	-15	0	0	-10	0
Stud 2	25	30	10	50	15	25	50	20	20
Stud 3	20	25	8	40	10	20	40	15	15

Figure 19 - General Skills input page

	Other Skills Raw Scores:				
	Attitude	Msn Plan/ Prep	Prec Fly	LOS Interpret	Compart
Low:	-10	0	0	0	-15
Hi:	25	30	10	50	15
Stud 1	-10	0	0	0	-15
Stud 2	25	30	10	50	15
Stud 3	20	25	8	45	10

Figure 20 - Other Skills input page

	Specific Skills Raw Scores:								
	Comm/ Listening	Cog Think/ Spatial Think	Info/Data Processing	Adv Form	Crew/Flt Coord	Mental Calc	Quick Thinking	Target ID	Map Reading/ Interpretation
Low:	-10	0	0	-15	0	0	0	0	0
Hi:	25	30	10	50	15	20	20	20	20
Stud 1	-10	0	0	0	-15	0	0	0	0
Stud 2	25	30	10	50	15	20	20	20	20
Stud 3	20	25	8	45	10	15	15	15	15

Figure 21 - Aircraft Specific Skills input page

UPT Grading

To comprehend how the skill score is obtained, the grading scheme must first be understood. Table 8 is an excerpt from the AETC pilot training syllabus and is similar for all

levels of flying training. When a student is first introduced to a maneuver, the instructor normally demonstrates the maneuver prior to the student performing and practicing the event. If the student does not perform the maneuver on the same sortie it was demonstrated, the grade will be "NG" or 1. Also, when a student is solo and the instructor can not observe the performance, the grade will be NG. The levels of performance for each grade level are shown in the table. The MIF is a table of levels of expected performance. A student needs to achieve the established MIF at the end of a block of training. A category of training, for example contact, consists of many blocks of training with progressively increasing MIF levels.

Table 8 - Grade Definitions

Proficiency Maneuver Grades MIF Level Description

No Grade (NG) 1 Enter NG on the record of training when the maneuver is demonstrated by an instructor pilot on a dual sortie. On solo sorties enter NG for maneuvers flown, but not observed.
Unsatisfactory (U) 2 The student is unsafe or unable due to lack of sufficient knowledge, skill or ability to perform the operation, maneuver, or task.
Fair (F) 3 The student performs the operation, maneuver, or task safely but has limited proficiency. Deviations occur that detract from performance and/or verbal prompting was required from the instructor.
Good (G) 4 The student performs the operation, maneuver, or task satisfactorily. Deviations occur that are recognized and corrected in a timely manner without verbal prompting from the instructor.
Excellent (E) 5 The student performs the operation, maneuver, or task correctly, efficiently, and skillfully. Minor deviations occur that do not detract from the overall performance.

Model Calculations

There are several calculations performed by the model to provide a best fit result. The two main results are the Pilot Ability score and the Best Fit match. The Pilot Ability score is given by:

$$\textbf{Pilot Ability (PA) Score} = \textbf{General Skills Score} + \textbf{Other Skills Score} + \textbf{Average (Aircraft Specific Skills Scores)} \qquad (2)$$

The PA score is used for overall ranking and comparison of the students in a particular class. This score will be used for award determinations, Distinguished Graduate certificates, etc.

The Best Fit determination only considers the Aircraft Specific Skills and the student's preference. A score for each aircraft type is obtained and the highest three scores produce an aircraft match. Each aircraft score is given by:

Aircraft Score = Specific Skills Score + 10% of Preference Score (3)

The skills set score begins with the grades received by the student on every sortie for every maneuver/skill event. Figure 22 shows the general flow used in the calculations. The number in parenthesis indicates the applicable equation number or figure.

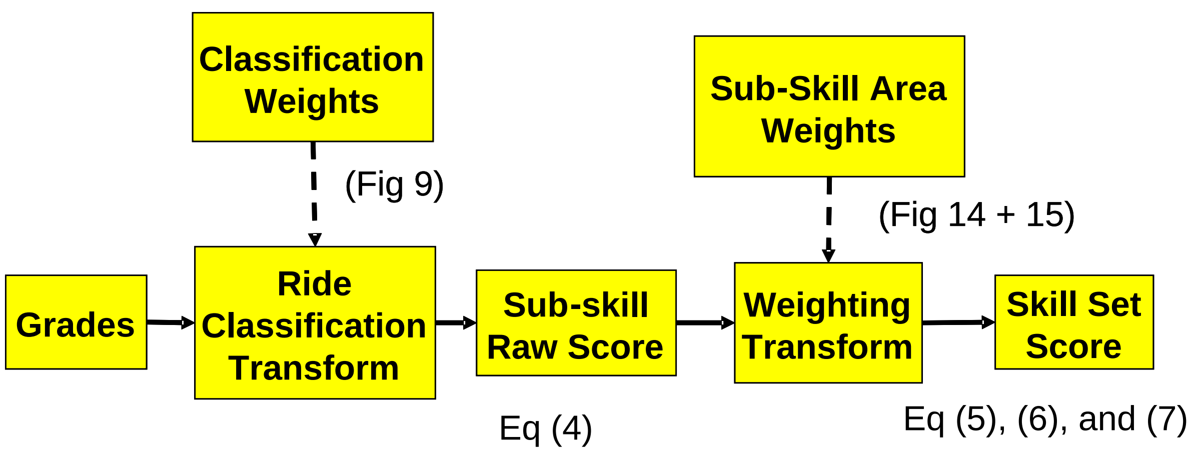


Figure 22 - General Calculation Flow

Specific Model Calculations

The sub-skill score is the overall average grade deviation from the expected performance on a given sortie. The sortie classification weighting is applied for each grade received

$$\textbf{Sub-Skill Score} = \sum^{\#\_event\_types} \left(\frac{\sum_{s=1}^{n} (Grade_s - MIF_s) * SCW}{n} \right) \qquad (4)$$

Where $Grade_s$ is the numeric grade received during the sortie, MIF_s is the standard for the sortie, n is the number of sortie where the maneuver/item was flown and graded and SCW is the Sortie Class Weight (see Figure 9).

The PA score is calculated with all three skill sets using the following equations:

$$\textbf{General Skills Score} = \left(\sum_{i=1}^{9}(S_i + Shift_i) * F_i\right) * 100 \qquad (5)$$

$$\textbf{Other Skills Score} = \left(\sum_{i=1}^{5}(S_i + Shift_i) * F_i\right) * 100 \qquad (6)$$

$$\textbf{Aircraft Skill Score} = \left(\sum_{i=1}^{9}(S_i + Shift_i) * F_i * W_i\right) * 100 \qquad (7)$$

Where: S_i = Raw Score, $Shift_i$ = Shift for skill i, F_i = Factor for skill i, and W_i = Aircraft weighting for skill i.

Since each aircraft type has a different weighting for the sub-skills in the Specific Skills set, an aircraft factor was applied to the overall skill set score. When determining the PA score, the eight aircraft specific scores are averaged. Each of the above equations is multiplied by 100 for ease of reading the scores when entering the values into the Excel model.

As stated previously, a shift and factor are used to normalize the data between sub-skill sets prior to the weighting being applied and are given by:

$$\textbf{Shift for skill i = - low value} \qquad (8)$$

$$\mathbf{F_i} \textbf{ = Factor for skill i = } \frac{1}{Hi - Low} \qquad (9)$$

Figure 23 shows an example of the sub-skill determination demonstrating how the shift and factors are calculated and used.

Low = -10 High = 10 Factor = $\dfrac{1}{10-(-10)} = .05$ Shift = 10	
Score	**Value**
-10	0
0	.5
5	.75
10	1

Figure 23 – Example Sub-Skill calculation

For the model, a starting place for the skill set scores range from 0 to 100. All of the weighted scores result in a value from 0 to 1. Note the high and low values and the score ranges are arbitrary. As the actual database tables are developed, these values may change to reflect the actual scores obtained by the students in pilot training.

Sub-Skill Calculation Example

The following is an example of how the sub-skill calculation is determined. There are close to 10,000 recorded events in UPT for each student. This example is a much simplified version but will show the general concept.

For each stage of training, a particular event may have a MIF that changes as the student gains experience. These increasing expectations are captured in a master table database. Again, for simplification, a set MIF is used. From Equation (4), the sub-skill score is determined using average of the deviations from MIF then summed over each event type. For example, the skill Map Reading is comprised of the following UPT events: Pilotage, Heading Control, Mission Planning (Low Level), and Temporary Flight Restrictions (TFR’s). Note that TFR awareness is not currently a graded item in UPT and is one of many suggested changes to the syllabus.

Table 9 – Example MIF Calculation

Event	MIF	Average deviation from MIF	Min	Max	# times event practice/performed	Average
Pilotage	+3	5	-15	30	15	.33
Heading Control	+4	10	-99	50	50	.2
Mission Planning (Low Level)	+3	12	-10	20	10	1.2
TFR's	+4	10	-19	10	10	1

The low and high values are calculated based on the UPT rules set. A "No Grade" has a grade value of 1 and can only be demonstrated once by an instructor or any time solo. To pass a block of training, a student must achieve a grade equal to or greater than MIF on the last ride in a block of training. The minimum score is calculated accounting for the least number of points available where the student is furthest away from the MIF in the negative direction but still achieving MIF by the end of the block of training. The maximum is determined from a student achieving "excellent" grades on each performance of the maneuver and the deviation from MIF summed. The student in this example (Table 9) would receive a score for Map Reading of 2.73. Note, because Heading Control is a skill not just performed and graded in low level, the number of completed events is much greater than the other areas.

Model Output

Figure 24 shows the model output. The entire class is listed with an overall ability score, which is comprised of the three broad skill scores, and the top three aircraft in rank order. As part of the calculations, a "cut-off" point is used. If the student's ability score is less than the

cut-off, the term “washout” is displayed indicating the student has failed to meet a minimum level of ability. This level can be adjusted from the initially set score of 50. Normally, the regular syllabus contains provisions for students who do not meet minimum standards. If the model is used for mid-term feedback, the results page can provide a potentially valuable indicator that a student is not meeting the minimums even if they have not met the “triggers” in the syllabus.

Student ID	Student Name	Pilot Ability Score	Best Fit	Second Best Fit	Third Best Fit
1		0.000	washout	washout	washout
2		261.250	F-15E	F-16	F-15C
3		217.353	Bomber	F-15C	F-16
4		33.024	washout	washout	washout
5		33.024	washout	washout	washout

Figure 24 - Results/Output Table

The decision maker can request a “run” at any time during the course of pilot training. The run output will provide the necessary data for input into the model. Follow-on development of the model will automate this process.

Model Uses

The primary use of the model is obviously for student assignment recommendations. Once the information is entered into the spreadsheet model, the top three aircraft results are displayed. These three aircraft best match a student’s skills and current ability. In theory, the student will perform the best by receiving the suggested aircraft assignment. By assigning a student based on his/her strengths, remedial training in later, more expensive stages of training should be reduced or eliminated. As with any model, the result is only a recommendation and the ultimate choice still lies with the decision maker.

The model also has the side benefit of providing feedback at any time during the course of pilot training. By conducting a run, the instructor core can view the current student rankings

within a class and the skill levels of each student. If a particular student is weak in a skill area, the instructors can use this information to focus their efforts and assist the student in improving this weak skill area.

Once students receive their aircraft assignments, the model can be again used to identify remaining deficiencies as related to their assigned aircraft. One possibility is to use a “flexible” syllabus. Toward the end of the UPT syllabus, two to three “free profile” sorties could exist for the instructors to use for additional training for the student. These sorties would be dedicated toward improving the student’s weakest skill areas prior to graduation. For example, a student is assigned to an F-16 but still has a weak area of Target Identification. The additional sorties can be dedicated to target identification practice.

Overall

As previously stated, no two students learn at the same rate. For some, the “light bulb” doesn’t come on until well into pilot training. It is said that given enough hours and sorties, anyone can fly. The reality is there is not an infinite supply of training funds and there is a limit on time and space for training students in UPT. The syllabus guides the instructors in the development of a new pilot providing a framework and timeline. At some point in the training timeline, a decision must be made to the student’s future. In many cases, this assignment decision will impact the student for their 20+ year career.

The model presented here is a tool to aid the decision maker in assigning students based on their current skill and ability. No model is perfect but the information provided can assist in making the best choice fit for the student at the designated time in the program.

VI. Recommendations

Overview

The overarching goal of this research effort was to develop an assignment model for use at ENJJPT and ultimately, as part of the USAF UPT student assignment process. A model, though, is only useful if the end-user is able to implement the necessary provisions. This chapter discusses the following general list of recommended changes for implementation:

1) Change USAF and AETC training policy for all pilot training to be skills based
2) Incorporate the assignment model and skills concept into the ENJJPT ’08 plan
3) Use the model to guide decision makers on aircraft assignment of UPT students
4) Modify all UPT training syllabi to reflect the skills based approach
5) Develop further models for use as feedback tools at follow-on training units
6) Continue to define and refine skill sets for every level of training
7) Develop procedures for use as a mid-course feedback and guidance
8) Modify the UPT syllabi using feedback to improve skills of weaker students

Policy Change

The single largest paradigm shift is the concept of skills based training, evaluation and assignment in the UPT environment. AETCI 36-2205 is the governing instruction on training conduct within AETC. To reflect the change in philosophy, this regulation would need to be rewritten to present the concept of skills based training, present the assignment model, and direct implementation at the wing level.

Any other training policy directives from AETC must also be addressed. Since the conduct of UPT has changed relatively little over many decades, leadership support is key to the success of implementation and requires thorough understanding of why this program should be

executed. The skills based method provides a cradle to grave approach to pilot production. Skill sets at each stage of upgrade will be defined resulting in a focused training effort with a goal of providing the CAF with a pilot possessing robust, defined and necessary skills to effectively complete today's complex combat mission.

ENJJPT '08 Plan

The ENJJPT '08 plan is still in development and timing is crucial for inclusion into the final concept. As part of the plan, the syllabus for each phase of training at Sheppard is being rewritten. By adopting the skills based approach, these new syllabi can be written from the skills perspective with a fresh look at each maneuver flown. The missions can be developed with a clear objective stated for the sortie as to what skill is introduced, practiced, and evaluated.

Since ENJJPT is governed by the SC, buy-in from the NATO partners is necessary throughout the development of the new training program. The skills concept needs to be introduced at the earliest stage of the plan development to provide the greatest opportunity for understanding and acceptance by the SC.

Assignment Model

The core of this effort was the development of the assignment model. This model can be used by the decision maker as a tool to objectively determine the best aircraft assignment for the student. As stated before, the model is but one of many tools to be utilized. Use of the model will move the current process away from rank-ordered selection. Top performing students most likely will not see any benefit from the model but for the weaker, struggling students, the model provides a means of fairness and assurance concerning their assignment. These students can know they are being assigned to the best assignment for their individual talents.

Changes to UPT and the Syllabus

The current training approach in UPT is to fly a set of maneuvers to achieve an objective. The orderly flow of sorties and specific set of maneuvers constrains the instructor to a somewhat scripted approach often preventing the practice of needed skills. The proposed approach to training would allow an instructor greater freedom to focus on a student's weak areas. A training plan can be developed and modified as the student improves and achieves the desired levels of ability.

Appendix G shows the list of skills and related UPT events. The highlighted events are those not explicitly graded in the current UPT environment. Some of these areas fall into several categories of maneuvers and some are not currently taught. As part of the syllabus examination and refinement of the skill definitions, a thorough review of events and maneuvers should be completed. Where necessary, new maneuver definitions should be inserted and others combined or eliminated.

Codifying the events as they relate to skills and providing narrow definitions gives the instructors a mission objective and focus for the sortie. The student can in turn understand the skill area and focus their preparation efforts to the understanding and application of the skill. For example, a student needs to fly aerobatic maneuvers (loop, roll, etc). The intention is not to fly precise maneuvers in the sky or for an air show but rather to understand the concepts of aircraft control. Clearly stating the skill area in the syllabus provides the student a definitive focus.

Specific recommendations resulted from the FCSS and ENJJPT MASS Working Group:

1) Students should brief the mission/sortie. The student not only learns and practices communication skills, but is forced to craft and present a coherent plan. Additionally, they are developing their cognitive thinking skills.

2) Students should continue to lead in formation. There should be less emphasis on flight leadership but the student still needs to have basic skills in this area. The recommendation is for the student to continue leading to and from the area with the instructor taking charge in a greater capacity within the area during maneuvering. The student is developing cognitive and decision making skills but the expectations should be lowered concerning flight leadership.

3) The instrument training should be shifted down to the T-6 and a greater emphasis placed on aircraft handling and formation in the T-38.

Follow-on Training Models

A key benefit from this type of model is the use of the mid-course feedback to probabilistically predict the future performance of the student. Through evaluation of current abilities and application of required/desired skills, an assessment can be made. Since some students comprehend subject material at varying rates, the model will not perfectly predict the future. However, for the majority of students, the model will closely identify their potential.

Having predictive models at various stages of training can assist the instructors in objectively identifying weak areas allowing for a focused training plan to be created and used. Conducting remedial training at less expensive stages of training will benefit the Air Force and most likely benefit the student. Correcting weak areas at early stages of training would allow the student to continue in the training pipeline without having to deviate to another MWS due to failure from these deficiencies.

VII. Future Research

Further Validation and Interface

There are two primary tasks remaining prior to model implementation – completing the validation and developing a technical interface. As stated multiple times, approval to conduct research on currently enrolled students was not obtained in a timely manner. As a result, the model could not be completely validated with actual student data. Subject Matter Experts were used in the testing and initial confirmation of the model but further validation is warranted. The survey in Appendix H is a template which can be used to relate student skills to the model. The data results from these surveys can be compared to the AETC database and model refinements made from the results.

A technical interface to extract grade data from TIMS needs to be developed. When the decision maker requests a run, the transfer of data needs to be seamless and automatic. The grade data is crucial to the model operation. Without the interface, the assignment model is only a concept.

UPT Changes

One of the recommendations from the previous chapter is to consolidate some of the current UPT grades. Although the skills listed in Appendix G have associated UPT events, a complete review of maneuvers taught during UPT needs to be accomplished to ensure all the skills are properly matched and defined.

Skill grades should be considered over a student receiving individual maneuver grades. For example, a student flying aerobatics will be graded in loop, cloverleaf, barrel roll, etc. A proposal is for the student to be graded in the skill areas represented by the maneuvers – aircraft control, precision handling, entry parameters, etc. A student would still be required to fly the

variety of aerobatic maneuvers but would be graded not on the maneuver, but on their ability in the particular skill area.

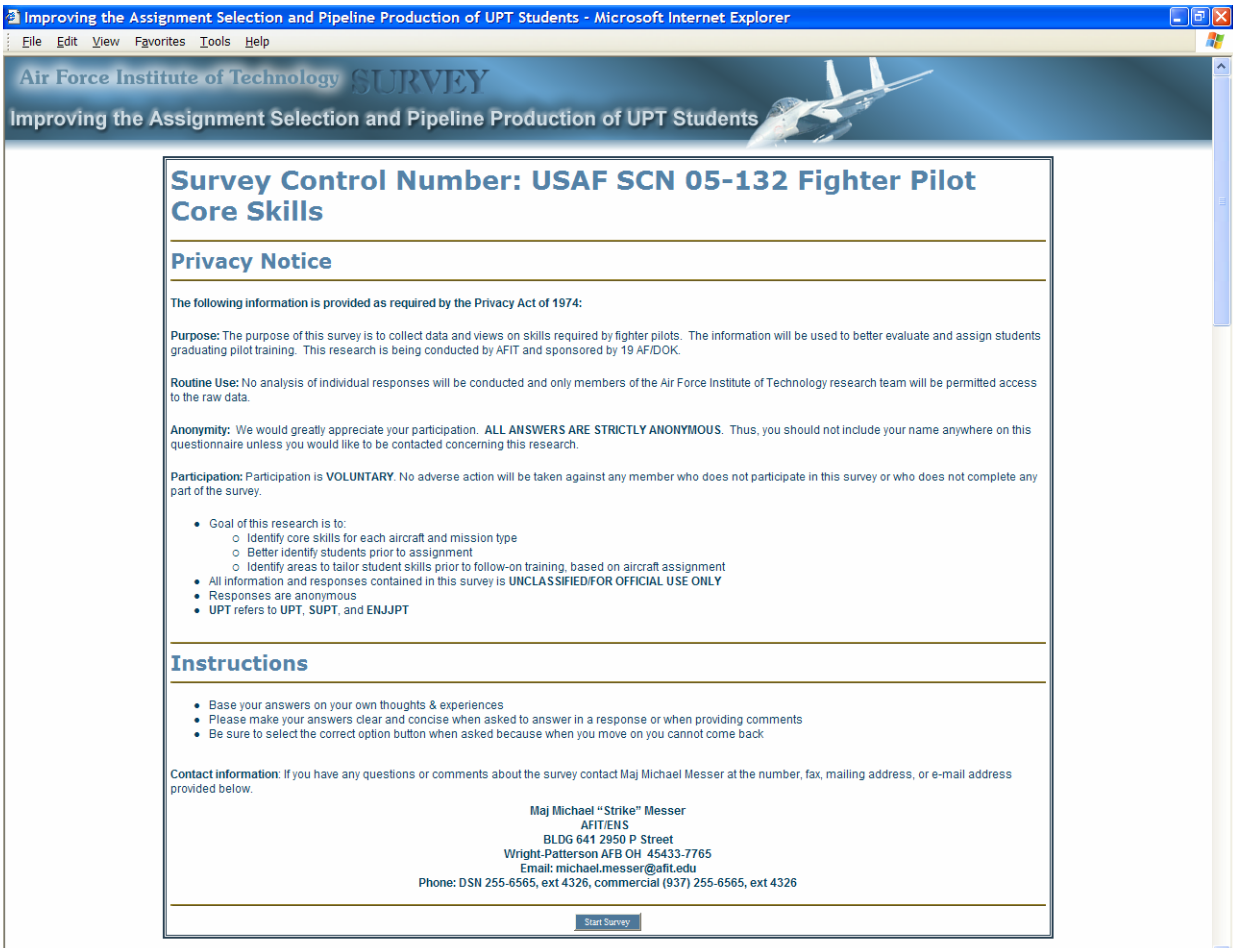
Final Thoughts

Assignment night in pilot training is one of the most memorable events in a young aviator's career. The events leading up to their selection are trying and at times, heartbreaking. UPT is only the start for the student. Follow-on training increases in intensity and the new pilot will be tested to the maximum of their capabilities physically, mentally, and emotionally. Providing the tools necessary to achieve success is the primary goal of UPT.

Identifying the necessary skill sets and accomplishing training based on these requirements is the best approach to successfully achieving the goal of equipping pilots for their future training needs. Doing so smartly benefits not only the individual, but the Air Force. Reducing the need for remedial training and retraining saves valuable resources and funds. The presented model can play a significant role in the effort to properly identify and assign students to maximize their talents and abilities.

Appendix A - Fighter Skills Survey #2

Appendix A is a copy of the Fighter Core Skills Survey (FCSS). The survey was sent to all fighter units in the CONUS. Each page represents a new screen. The survey was web based and data collection was anonymous. A summary of the data results can be found in Chapter IV.



Improving the Assignment Selection and Pipeline Production of UPT Students - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Air Force Institute of Technology SURVEY

Improving the Assignment Selection and Pipeline Production of UPT Students

Survey Control Number: USAF SCN 05-132 Fighter Pilot Core Skills

Privacy Notice

The following information is provided as required by the Privacy Act of 1974:

Purpose: The purpose of this survey is to collect data and views on skills required by fighter pilots. The information will be used to better evaluate and assign students graduating pilot training. This research is being conducted by AFIT and sponsored by 19 AF/DOK.

Routine Use: No analysis of individual responses will be conducted and only members of the Air Force Institute of Technology research team will be permitted access to the raw data.

Anonymity: We would greatly appreciate your participation. **ALL ANSWERS ARE STRICTLY ANONYMOUS**. Thus, you should not include your name anywhere on this questionnaire unless you would like to be contacted concerning this research.

Participation: Participation is **VOLUNTARY**. No adverse action will be taken against any member who does not participate in this survey or who does not complete any part of the survey.

- Goal of this research is to:
  - Identify core skills for each aircraft and mission type
  - Better identify students prior to assignment
  - Identify areas to tailor student skills prior to follow-on training, based on aircraft assignment
- All information and responses contained in this survey is **UNCLASSIFIED/FOR OFFICIAL USE ONLY**
- Responses are anonymous
- **UPT** refers to **UPT**, **SUPT**, and **ENJJPT**

Instructions

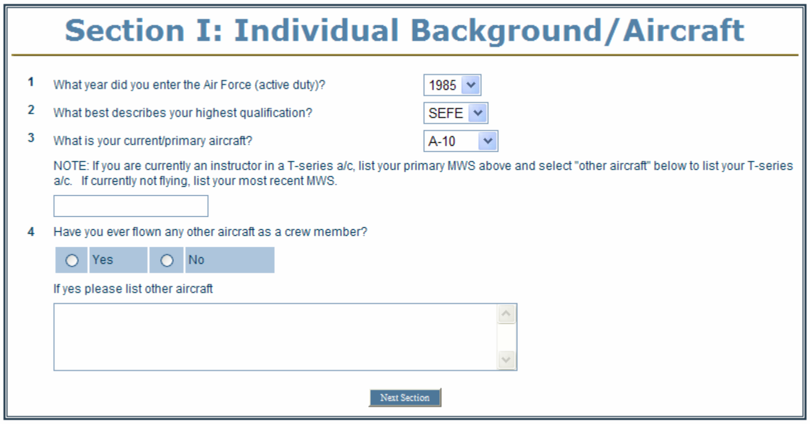
- Base your answers on your own thoughts & experiences
- Please make your answers clear and concise when asked to answer in a response or when providing comments
- Be sure to select the correct option button when asked because when you move on you cannot come back

Contact information: If you have any questions or comments about the survey contact Maj Michael Messer at the number, fax, mailing address, or e-mail address provided below.

Maj Michael "Strike" Messer
AFIT/ENS
BLDG 641 2950 P Street
Wright-Patterson AFB OH 45433-7765
Email: michael.messer@afit.edu
Phone: DSN 255-6565, ext 4326, commercial (937) 255-6565, ext 4326

Start Survey

Screen 1


Section I: Individual Background/Aircraft

1 What year did you enter the Air Force (active duty)? 1985

2 What best describes your highest qualification? SEFE

3 What is your current/primary aircraft? A-10

NOTE: If you are currently an instructor in a T-series a/c, list your primary MWS above and select "other aircraft" below to list your T-series a/c. If currently not flying, list your most recent MWS.

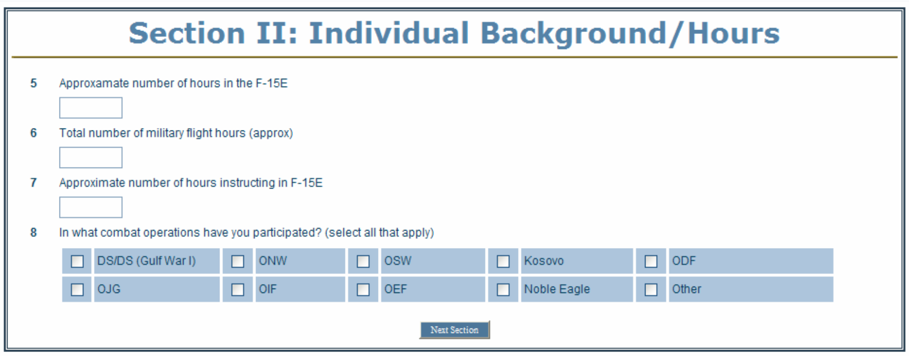
4 Have you ever flown any other aircraft as a crew member?

Yes No

If yes please list other aircraft

Next Section

Screen 2


Section II: Individual Background/Hours

5 Approxamate number of hours in the F-15E

6 Total number of military flight hours (approx)

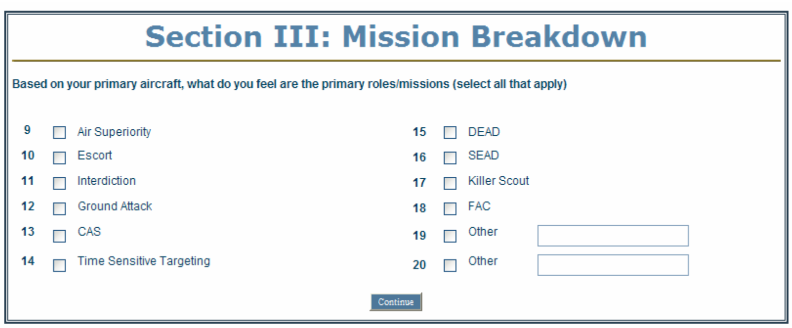
7 Approximate number of hours instructing in F-15E

8 In what combat operations have you participated? (select all that apply)

DS/DS (Gulf War I)	ONW	OSW	Kosovo	ODF
OJG	OIF	OEF	Noble Eagle	Other

Next Section

Screen 3


Section III: Mission Breakdown

Based on your primary aircraft, what do you feel are the primary roles/missions (select all that apply)

9 Air Superiority
10 Escort
11 Interdiction
12 Ground Attack
13 CAS
14 Time Sensitive Targeting
15 DEAD
16 SEAD
17 Killer Scout
18 FAC
19 Other
20 Other

Continue

Screen 4

Section III: Mission Breakdown (continued)

1. Advanced Formation Skills (tactical, FM, ext trail)
2. Aircraft handling
3. Basic Formation Skills (fingertip, route, close trl)
4. Cognitive/spatial Thinking
5. Communication
6. Compartmentalization
7. Crew/flight Coordination
8. Crosscheck
9. Discipline
10. Info/Data Processing
11. Line-of-Sight Interpretation
12. Listening
13. Map Reading/Interpretation
14. Mental Calculations
15. Multi-Tasking
16. Precision Flying
17. Quick Thinking
18. Risk management
19. Sensor Operations
20. Situational Awareness (SA)
21. System Knowledge
22. Target Identification
23. Task Prioritization

Using the list above and by entering its corresponding number in the boxes below, rank order up to the top four (Rank 1 being the highest), skills you feel are required to fly the _________ mission in F-15E

Air Superiority MISSION

Rank 1

Rank 2

Rank 3

Rank 4

List any additional skills you feel are required to fly the Air Superiority mission seperated by comma's

Interdiction MISSION

Rank 1

Rank 2

Rank 3

Rank 4

List any additional skills you feel are required to fly the Interdiction mission seperated by comma's

Screen 5

Section IV: Board Area Skills

Board area skills needed to fly your aircraft.

1 **Basic Skills** are those needed by a pilot to fly any aircraft - fighter or otherwise. Sub-areas include general knowledge, task management, basic aircraft handling, risk management, communication, and airmanship. On a scale of 1 to 10 (10 being most important), how important are basic skills to flying your aircraft?

1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

2 **Instrument Skills** are those needed by a pilot to fly an aircraft under Instrument Flight Rules in both VMC and IMC. Areas include procedures, approaches (both normal and emergency) and precision aircraft handling. On a scale of 1 to 10 (10 being most important), how important are basic skills to flying your aircraft?

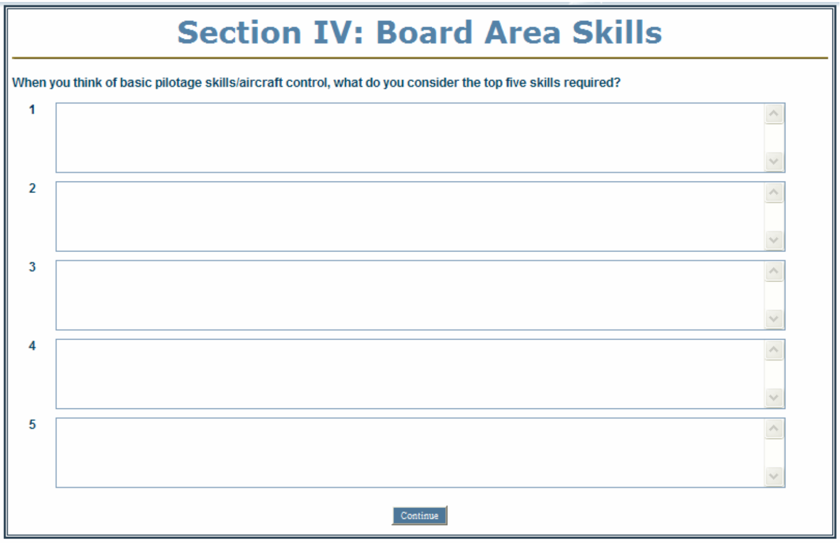
1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

3 **Mission Skills** are those needed by a pilot to fly and execute a tactical/combat mission. Sub-areas include situational awareness, formation skills, advanced aircraft handling, mission preparation, and mission execution. On a scale of 1 to 10 (10 being most important), how important are basic skills to flying your aircraft?

1	2	3	4	5	6	7	8	9	10
○	○	○	○	○	○	○	○	○	○

Next Section

Screen 6


Section IV: Board Area Skills

When you think of basic pilotage skills/aircraft control, what do you consider the top five skills required?

1

2

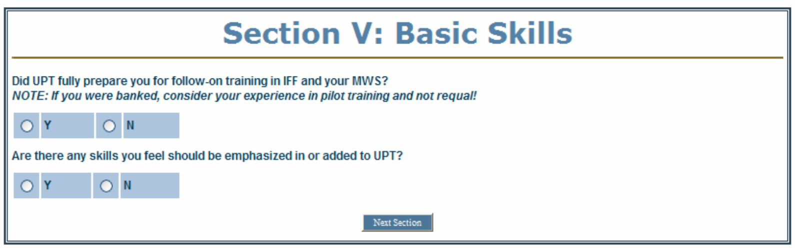
3

4

5

Continue

Screen 7


Section V: Basic Skills

Did UPT fully prepare you for follow-on training in IFF and your MWS?
NOTE: If you were banked, consider your experience in pilot training and not requal!

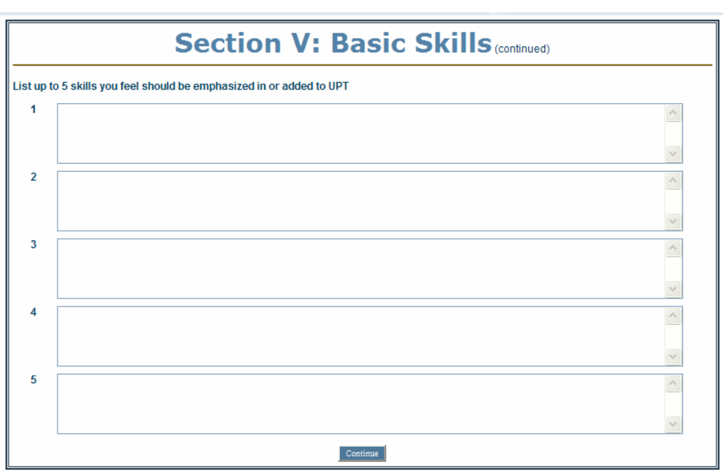
Y N

Are there any skills you feel should be emphasized in or added to UPT?

Y N

Next Section

Screen 8


Section V: Basic Skills (continued)

List up to 5 skills you feel should be emphasized in or added to UPT

1

2

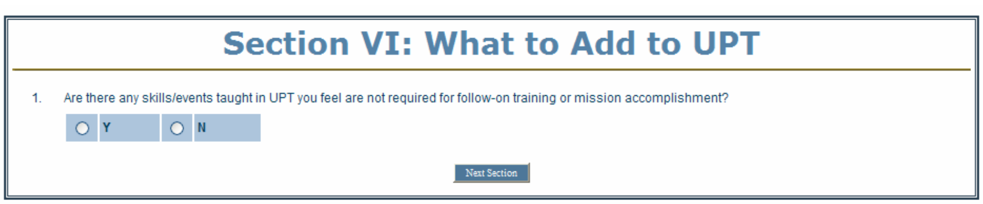
3

4

5

Continue

Screen 9

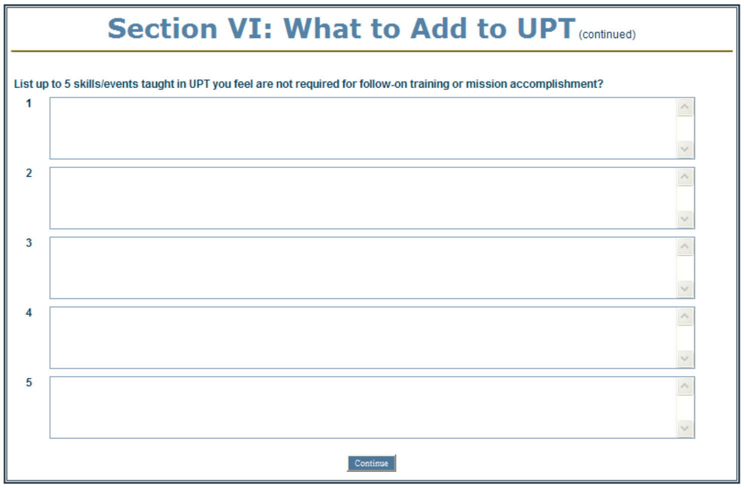

Section VI: What to Add to UPT

1. Are there any skills/events taught in UPT you feel are not required for follow-on training or mission accomplishment?

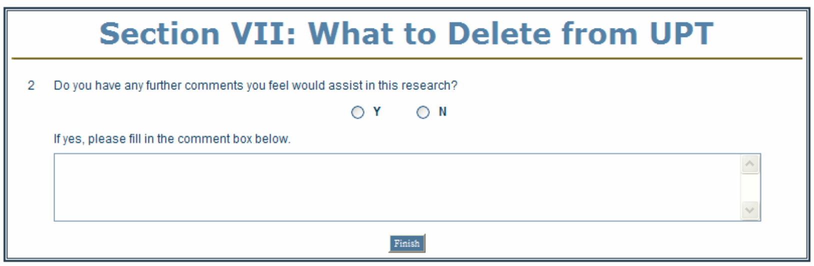
Y N

Next Section

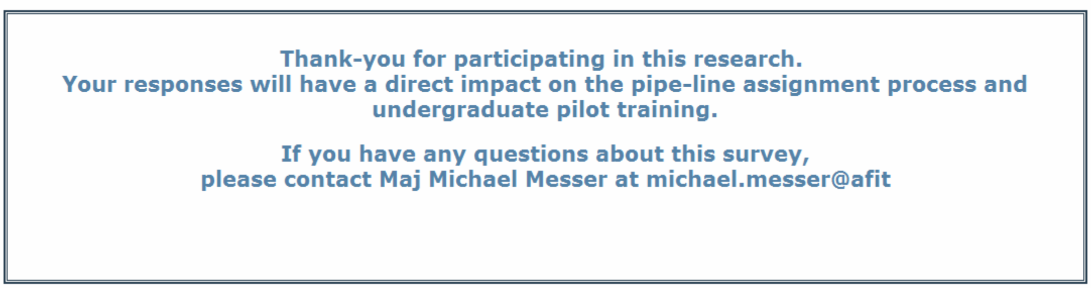
Screen 10



Screen 11



Screen 12



Screen 13

Appendix B - Mini Survey #1 – UPT Skills Breakdown

Appendix B is a skills survey sent to instructors at ENJJPT. The goal of the survey was to classify and assign maneuvers flown in UPT into three broad areas – Basic, Instrument, and Mission Skills.

Definitions:

Basic Skill - skills required and applicable to any aircraft

Instrument Skill - skills required to safely and effectively fly an aircraft in IMC and/or under IFR

Mission Skill - a skill that could be applied to a specific mission or aircraft type such as low level, air to air, etc

Instructions: For each task/maneuver, rank order the three broad areas. If an area does not apply, list a "0". If you have any comments, list them under notes.

Example:

	Task/Maneuver	**Basic**	**Instrument**	**Mission**	**Notes**
1	Mission Planning/Briefing/Debriefing	1	3	2	
2	ILS Normal	2	1	0	
3	G-Exercise/Awareness	2	0	1	

	Task/Maneuver	**Basic**	**Instrument**	**Mission**	**Notes**
1	Aerobatic Maneuvers (i.e. loop, barrel roll, etc)				
2	Area Orientation				
3	Clearing/Visual Lookout				
4	Close Trail				
5	Communication				
6	Emergency Procedures				
7	Fighting Wing				
8	Flight Integrity/Wingman Consideration				
9	Formation Join-up				
10	General Knowledge				
11	G-Exercise/Awareness				
12	Ground Operations				
13	Inflight Planning				
14	Local Area Procedures				
15	Map Preparation				
16	Risk Management/Decision Making				
17	Route Formation				
18	Tactical Formation				
19	Tactical Turns				
20	Task Management				

Are there any other tasks/maneuvers you feel span multiple broad areas?

Appendix C - Mini Survey #2 – Broad Area Skill relationships based on Fighter

Appendix C is a follow up to the survey found in Appendix B with the goal of obtaining weightings between the three broad areas based on fighter aircraft background.

Instructions: Select your current fighter aircraft or the one you were most recently qualified in. For each of the four categories, select a value from 1 to 100 indicating how important this skill area is toward flying the aircraft you selected. The fou

Fighter Aircraft:		(pull down menu)	
Basic Skills		(0 - 100%)	**Basic Skills** are those needed by a pilot to fly any aircraft - fighter or otherwise.
Instrument Skills		(0 - 100%)	**Instrument Skills** are those needed by a pilot to fly an aircraft under Instrument Flight Rules in both VMC and IMC.
Mission Skills		(0 - 100%)	**Mission Skills** are those needed by a pilot to fly and execute a tactical/combat mission.
Student Preference		(0 - 100%)	**Student Preference** acknowledges a student has a desire to fly a particular aircraft and is motivated by that desire.
	0%	(Must = 100%)	

Appendix D - Mini Survey #3 – UPT Weighting Breakdown

This is the third survey sent to ENJJPT instructors. The goal was to gather opinions and weightings for the four sortie classifications and between sub-skill areas within the three original broad areas. The surveys in Appendix B, C and D were then used to further develop and refine the FCSS.

Consider each of the following four areas (A through D). On a scale of 1 to 10 (10 being the greatest impact/most important) how would you rate the contribution of each of the following toward the overall evaluation of a student's performance and ability to fly fighter aircraft?

A) T-6/T-37 Daily rides:	
B) T-6/T-37 Checkrides:	
C) T-38 Daily rides:	
D) T-38 Checkrides:	
Total:	

Comments:

Basic Skills are those needed by a pilot to fly any aircraft - fighter or otherwise. There are six sub-areas to consider (listed below). Each sub-area is further broken into "practical" categories that directly relate to skills and maneuvers taught during pilot training. Given 100 points, distribute the points and assign each sub-area a point value as they relate to each of the other sub-areas. If there are other "sub-areas" you feel apply, add the category and point value.

General Knowledge:	
Task Management:	
Basic Aircraft Handling:	
Risk Management:	
Communication:	
Airmanship:	
Total:	100 points

Comments:

Instrument Skills are those needed by a pilot to fly an aircraft under Instrument Flight Rules in both VMC and IMC. There are three sub-areas to consider (listed below). Each sub-area is further broken into "practical" categories that directly relate to skills and maneuvers taught during pilot training. Given 100 points, distribute the points and assign each sub-area a point value as they relate to each of the other sub-areas. If there are other "sub-areas" you feel apply, add the category and point value.

Procedures	
Approaches	
Precision Aircraft Handling	
Total:	100 points

Comments:

Mission Skills are those needed by a pilot to fly and execute a tactical/combat mission. There are five sub-areas to consider (listed below). Each sub-area is further broken into "practical" categories that directly relate to skills and maneuvers taught during pilot training. Given 100 points, distribute the points and assign each sub-area a point value as they relate to each of the other sub-areas. If there are other "sub-areas" you feel apply, add the category and point value.

Situational Awareness:	
Formation Skills:	
Advanced Aircraft Handling	
Mission Preparation:	
Mission Execution:	
Total:	100 points

Comments:

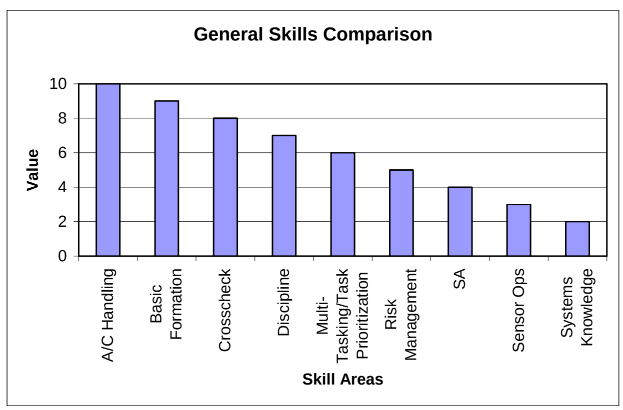
Appendix E - Updated Skills Survey

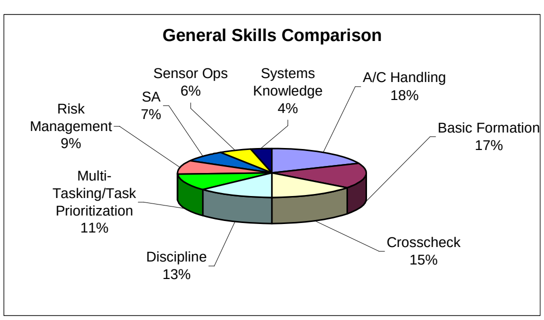
The original classification of skills was broken into three areas - Basic, Instrument and Mission (with Formation added during the working group). After data analysis, the framework was modified to General, Aircraft Specific, and Other Skills sets. The following short survey was sent to fighter pilots at AFIT and to instructors at ENJJPT to obtain some data under the new framework. A detailed definition listing (see Appendix G) and two visual graphic depictions of the answers were provided to assist the respondent. Many positive comments about the layout and format were received concerning the survey.

What I need is your opinion on the breakdown between the sub-skill areas. Attached is a spreadsheet with two tabs. Tab one defines each skill area. If you have any input, additions, or different opinions, add these to the third column. Tab two is the actual input area for the skill sets. For each skill area, rate the importance of the skill from 0 (not important at all) to 10 (a must have and the most important skill for a pilot to have). The chart to the right of the input will show the individual rating from 0 to 10. The pie chart shows the relative weight between each skill. If you give each skill area a 10 rating, the relative weights between all the skills in that area will be weighted equally - i.e. you feel all the skills under say General Skills are all equally important.

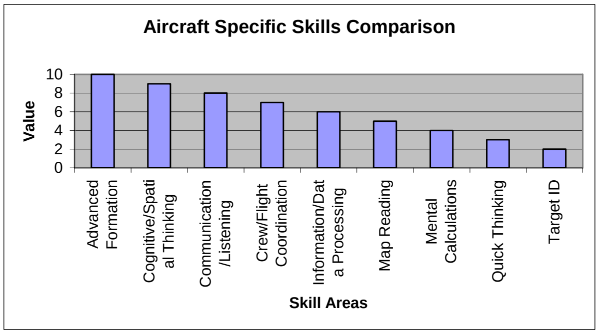
All three broad skill areas are on the same tab so you will have to scroll down to get to each area. Please open the file, add your input, save and FORWARD the file to michael.messer@afit.edu.

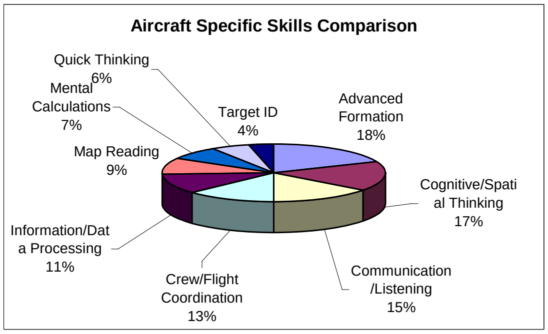
	Value (0 to 10)
General Skills	
A/C Handling	10
Basic Formation	9
Crosscheck	8
Discipline	7
Multi-Tasking/Task Prioritization	6
Risk Management	5
SA	4
Sensor Ops	3
Systems Knowledge	2



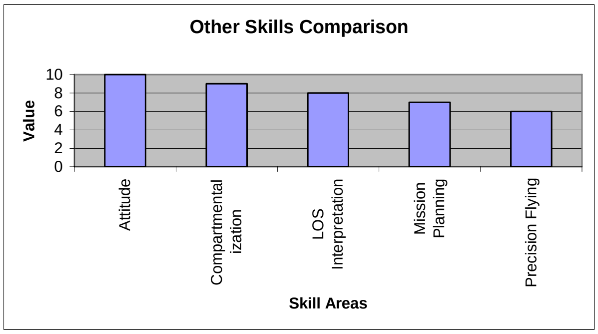


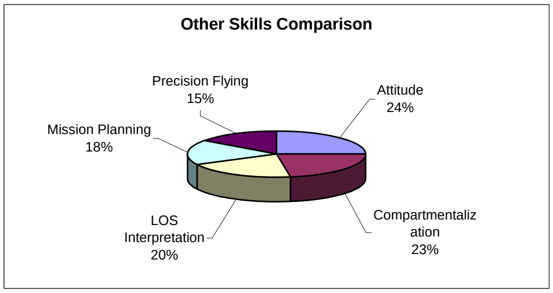
Aircraft Specific Skills	Value (0 to 10)
Advanced Formation	10
Cognitive/Spatial Thinking	9
Communication/Listening	8
Crew/Flight Coordination	7
Information/Data Processing	6
Map Reading	5
Mental Calculations	4
Quick Thinking	3
Target ID	2





Other Skills	Value (0 to 10)
Attitude	10
Compartmentalization	9
LOS Interpretation	8
Mission Planning	7
Precision Flying	6





Appendix F   Skills Survey Results

The following are a summary of results obtained from both the FCSS and other surveys.

All confidence intervals are 95%.

Total #s of responses:

	Survey #s
A-10	2
F-15C	65
F-15E	16
F-16	19
F-22	15
T-37	2
T-38	3
Total FCSS:	122
Other Survey	12
Total Skills Surveys:	134

Original Broad Area breakdown:

		Basic Skills	Instrument Skills	Mission Skills
A-10	Average	9.000	8.500	10.000
	SD	1.414	0.707	0.000
	CI:	0.063	0.031	0.000
F-15C	Average	9.062	7.508	9.708
	SD	1.144	2.070	0.605
	CI:	0.009	0.016	0.005
F-15E	Average	8.667	6.733	9.667
	SD	1.047	1.580	0.488
	CI:	0.016	0.025	0.008
F-16	Average	8.947	7.737	9.368
	SD	1.026	1.821	0.895
	CI:	0.015	0.026	0.013
F-22	Average	9.333	8.133	9.867
	SD	0.724	1.598	0.352
	CI:	0.012	0.026	0.006
T-37	Average	7.500	6.500	2.000
	SD	3.536	3.536	0.000
	CI:	0.157	0.157	0.000
T-38	Average	8.333	8.333	6.333
	SD	2.082	1.528	3.512
	CI:	0.075	0.055	0.127
Overall:	Average:	8.984	7.561	9.463
	SD:	1.145	1.921	1.332
	CI:	0.006	0.011	0.008

General Skills breakdown by aircraft type:

	SA	Multi-Task	Sensor Ops	Discipline	Risk Mgmt	A/C Handling	Crosscheck	Basic Form	Sys GK
A-10	9	13	1	1	1	0	0	0	1
Global:	15.5%	24.5%	1.7%	1.7%	1.7%	0.0%	0.0%	0.0%	1.7%
Local:	34.6%	50.0%	3.8%	3.8%	3.8%	0.0%	0.0%	0.0%	3.8%
F-15C	90	106	60	36	10	20	21	7	12
Global:	21.5%	28.1%	14.4%	8.6%	2.4%	4.8%	5.0%	1.7%	2.9%
Local:	24.9%	29.3%	16.6%	9.9%	2.8%	5.5%	5.8%	1.9%	3.3%
F-15E	36	57	33	3	6	0	9	0	3
Global:	20.8%	37.7%	19.1%	1.7%	3.5%	0.0%	5.2%	0.0%	1.7%
Local:	24.5%	38.8%	22.4%	2.0%	4.1%	0.0%	6.1%	0.0%	2.0%
F-16	51	63	53	11	9	0	14	0	8
Global:	20.8%	28.4%	21.6%	4.5%	3.7%	0.0%	5.7%	0.0%	3.3%
Local:	24.4%	30.1%	25.4%	5.3%	4.3%	0.0%	6.7%	0.0%	3.8%
F-22	55	53	18	6	8	0	11	0	7
Global:	29.1%	32.9%	9.5%	3.2%	4.2%	0.0%	5.8%	0.0%	3.7%
Local:	34.8%	33.5%	11.4%	3.8%	5.1%	0.0%	7.0%	0.0%	4.4%
T-37	1	0	0	1	1	1	0	0	0
Global:	20.4%	0.0%	0.0%	20.4%	20.4%	20.4%	0.0%	0.0%	0.0%
Local:	25.0%	0.0%	0.0%	25.0%	25.0%	25.0%	0.0%	0.0%	0.0%
T-38	2	3	0	1	0	2	1	1	0
Global:	14.7%	25.8%	0.0%	7.3%	0.0%	14.7%	7.3%	7.3%	0.0%
Local:	20.0%	30.0%	0.0%	10.0%	0.0%	20.0%	10.0%	10.0%	0.0%
Other Survey	13.6%	13.1%	8.9%	12.2%	10.0%	12.8%	13.3%	5.6%	10.5%
		26	12.5	9.5	7	8.5	6.5	2	3
Avg:	20.26%	21.68%	10.15%	10.40%	8.20%	9.99%	9.19%	3.65%	6.49%
SD:	4.73%	12.05%	9.16%	6.56%	6.88%	8.44%	2.94%	2.74%	1.49%
CI:	0.02%	0.04%	0.04%	0.05%	0.07%	0.11%	0.02%	0.06%	0.02%

Aircraft Specific Skills breakdown:

	Comm	Cog/Spatial Thinking	Info/Data Proc	Adv Form	Crew Coord	Mental Calc	Quick Think	Tgt ID	Map Read
A-10	2	2	7	0	1	1	2	9	0
Global:	3.4%	3.4%	12.1%	0.0%	1.7%	1.7%	3.4%	15.5%	0.0%
Local:	8.3%	8.3%	29.2%	0.0%	4.2%	4.2%	8.3%	37.5%	0.0%
w/other surv	12.5%	8.3%	21.3%	1.7%	7.9%	8.8%	10.0%	24.6%	5.0%
F-15C	77	43	43	49	11	17	33	10	4
Global:	20.1%	10.3%	10.3%	11.7%	2.6%	4.1%	7.9%	2.4%	1.0%
Local:	26.8%	15.0%	15.0%	17.1%	3.8%	5.9%	11.5%	3.5%	1.4%
w/other surv	20.3%	15.0%	13.8%	15.3%	7.0%	7.6%	10.7%	5.7%	4.5%
F-15E	23	21	16	11	25	4	7	26	3
Global:	13.9%	12.1%	9.2%	6.4%	14.5%	2.3%	4.0%	15.0%	1.7%
Local:	16.9%	15.4%	11.8%	8.1%	18.4%	2.9%	5.1%	19.1%	2.2%
F-16	41	26	17	14	8	10	10	22	0
Global:	18.0%	10.6%	6.9%	5.7%	3.3%	4.1%	4.1%	9.0%	0.0%
Local:	27.7%	17.6%	11.5%	9.5%	5.4%	6.8%	6.8%	14.9%	0.0%
w/other surv	20.2%	14.8%	12.1%	10.8%	8.2%	7.9%	9.2%	14.0%	2.9%
F-22	7	20	33	0	2	7	16	0	0
Global:	3.7%	10.6%	17.5%	0.0%	1.1%	3.7%	8.5%	0.0%	0.0%
Local:	8.2%	23.5%	38.8%	0.0%	2.4%	8.2%	18.8%	0.0%	0.0%
T-37	1	0	0	1	2	0	0	0	0
Global:	20.4%	0.0%	0.0%	20.4%	40.8%	0.0%	0.0%	0.0%	0.0%
Local:	25.0%	0.0%	0.0%	25.0%	50.0%	0.0%	0.0%	0.0%	0.0%
T-38	1	2	0	0	1	1	2	0	1
Global:	7.3%	14.7%	0.0%	0.0%	7.3%	7.3%	14.7%	0.0%	7.3%
Local:	12.5%	25.0%	0.0%	0.0%	12.5%	12.5%	25.0%	0.0%	12.5%
Average:	17.19%	15.64%	12.74%	9.86%	16.42%	6.53%	11.48%	6.46%	3.68%
SD:	6.03%	8.89%	14.20%	9.56%	17.32%	4.41%	9.11%	8.28%	4.65%
CI:	0.03%	0.05%	0.08%	0.07%	0.14%	0.04%	0.06%	0.06%	0.07%

Other Skills breakdown:

	Prec Fly	LOS Interp	Compart	Attitude	MSN Prep
A-10	0	3	0		
Global:	0.0%	5.2%	0.0%		
Local:	0.0%	100.0%	0.0%		
F-15C	8	1	6		
Global:	1.9%	0.2%	1.4%		
Local:	53.3%	6.7%	40.0%		
F-15E	0	1	1		
Global:	0.0%	0.6%	0.6%		
Local:	0.0%	50.0%	50.0%		
F-16	5	5	1		
Global:	2.0%	2.0%	0.4%		
Local:	45.5%	45.5%	9.1%		
F-22	0	0	1		
Global:	0.0%	0.0%	0.5%		
Local:	0.0%	0.0%	100.0%		
T-37	0	0	0		
Global:	0.0%	0.0%	0.0%		
Local:	0.0%	0.0%	0.0%		
T-38	0	0	0		
Global:	0.0%	0.0%	0.0%		
Local:	0.0%	0.0%	0.0%		
Other Survey	15.00%	18.44%	20.31%	27.81%	18.44%
Avg:	1.67%	1.15%	0.42%	1.28%	0.85%
SD:	0.97%	1.92%	0.52%		
CI:	0.02%	0.04%	0.01%		

Note: Attitude and Mission Prep were not included in the FCSS. Because of the lack of data from the FCSS and the potential incorrect valuing, only the data from the Update Skills survey was used for the Other Skills set.

Appendix G UPT/Skill Relationships and Definitions

The following table defines each sub-skill area with a relationship to one or more UPT events. The skill areas are classified by broad area. Note the highlighted areas are UPT events not specifically or currently graded.

Broad Area	Skill Specific	UPT Event	Definition and application to skill area
General	SA	Area Orientation	Awareness of position in the area
		Fuel Awareness	Awareness of fuel state
		G Awareness	Awareness of aircraft G and relationship to max performance
		In-Flight Planning	Adjusting profile to meet changes in surroundings (weather, status, IP input, mission accomplishment, fuel state)
		Pattern Procedures	Positional Awareness and following proper procedures
		Situation Recognition	Does the student recognize a dangerous situation developing?
General	Multi-Tasking/Task Prioritization	Basic Aircraft Control	Prioritizations; aviate, navigate, communicate
		Checklist Usage	Proper use of checklist in all phases of flight
		Composite Profiles	Ability to complete a composite profile
		Emergency Procedures	Proper application of procedures; solid understanding of procedures under emergent conditions
		Enroute Procedures	Ability to prioritize in-flight tasks concerning mission profile, obtaining destination information, following established procedures, etc
		In Flight	Does the student make proper use of all resources available and/or request additional assistance when needed?
		Instrument Approaches	Ability to follow procedures
		Leading Formation	Understanding of the multi-aircraft environment and the decisions necessary to maintain control; ability to handle tasks beyond simple aircraft control in relation to other aircraft
		Low Level	Incorporating all inputs to successfully fly in LL environment
General	Sensor Ops	Cross Check	Ability to monitor multiple inputs at once; inputs can be instruments, other aircraft, radio, etc
		Wingman Consideration	Aircraft control and consideration of external inputs affecting the formation - sun, G-on set, etc
General	Discipline	Wingman Procedures	Adherence to contracts and established procedures
		Eps	Thoroughness and handling of emergency procedures
		GK	Thoroughness of knowledge as it relates the mission flown
		Mission Planning	Thoroughness of completion of mission planning and preparation
		Solo Sorties	Adherence to rules and regulations without IP input

Broad Area	Skill Specific	UPT Event	Definition and application to skill area
General	Risk Management	Area orientation	Adjusts profile and/or aircraft maneuver to properly maintain area boundaries
		Form landing	As lead: during landing phases assess the risk and ability of the formation to properly and safely execute a formation landing; As wing: determines when the risk level and safety exceed acceptable margins
		Formation Rejoins	Ability to assess angle and closure and understands the tradeoffs between safety and timeliness
		Fuel	Approaches profile management with a consideration for fuel state and maneuvers remaining
		Go-around	Recognizes the need to terminate a landing approach
		In-flight planning	Considers the risk posed by all external and internal factors affecting the flight
		KIO procedures	Recognizes the need to terminate maneuvering prior to unsafe condition impacting the flight
		Overshoots/breakouts	Recognizes the need to overshoot and/or breakout during formation maneuvering/rejoin
General	A/C Handling	Acro	Aircraft feel and control to specific parameters
		Airmanship	Aggressiveness to be on parameters; confidence
		Echelon Turn	Aircraft feel and control to specific parameters
		Fingertip	Aircraft feel and control to specific parameters
		FM	Max performance of aircraft
		Instrument Approaches	Aircraft feel and control to specific parameters
		Patts/land	Aircraft feel and control to specific parameters
		Special Syllabus	Aircraft feel and control
		Spins	Aircraft feel and control
		Stalls	Aircraft feel and control
General	Crosscheck	Area Orientation	Monitoring area position in relation to aircraft movement and projected course
		Clock-map-ground	Ability to fly the aircraft while maintaining certain parameters and monitoring the ground and movement over the ground
		Formation Approach	Ability to fly aircraft while monitoring other aircraft
		In flight planning	Monitoring the profile in relation to the aircraft, airspace, fuel state, etc
		Instruments	Uses a proper instrument crosscheck to maintain a smooth platform for instrument flying
		Over the top aerobatics	Flying the aircraft within certain parameters on over-the-top maneuvers
		Patt/landing	Ability to fly aircraft while monitoring other aircraft and the ground and following proper procedures
		Tac Position	Ability to fly aircraft while monitoring other aircraft
		Tac Turn Contract	Ability to fly aircraft to certain parameters while monitoring other aircraft
		Vertical S	Use an effective instrument scan to incorporate all cockpit instruments

Broad Area	Skill Specific	UPT Event	Definition and application to skill area
General	Basic Formation	Form T/O and Landing	Safely execute Wing T/O and Landing
		Fingertip	Ability to fly in close formation on the wing
		Route	Ability to fly in close formation on the wing
		Close Trail	Ability to fly in close formation on the wing
		Crossunder	Ability to fly in close formation on the wing
General	Systems Knowledge	Academics	Knowledge and application of information learned in a classroom setting
		EPQs	Knowledge and application of information learned in a classroom setting
		Emergency Procedures	Does the student apply knowledge?
		General Knowledge	Knowledge and application of information learned in a classroom setting
		Ground Ops	Application of systems knowledge learned in a classroom to pre-flight of the aircraft; properly follows procedures and can answer questions related to aircraft systems during pre-flight
		In flight	Ability for the student to apply knowledge vs straight academic response
		SIMs	Knowledge and application of information learned in a classroom setting
		Stand-ups	Knowledge and application of information learned in a classroom setting

Broad Area	Skill Specific	UPT Event	Definition and application to skill area
Aircraft Specific	Communication/Listening	Brief/Debrief	Ability to receive and translate information given in the pre-flight brief; ability to reconstruct and communicate information about the flight in the debrief
		Communication	Proper use of language skills for the safe and proper execution of the mission
		Comm Out Procedures	Proper use of non-verbal communication procedures for the safe and proper conduct of the mission
		Formation	Proper use of verbal and visual cues to control the formation and provide the necessary information to the flight lead while in flight
		Mission Planning	Makes appropriate inquiries about the mission, asks the necessary questions for clarification and to obtain the necessary information to conduct proper mission planning
		Out and Back	Effectively communicates with all the appropriate agencies to ensure the safely and successful completion of the O+B mission
		XC	Effectively communicates with all the appropriate agencies to ensure the safely and successful completion of the XC mission
Aircraft Specific	Cognitive Thinking	Area Planning	Understands aircraft position in relation to the area boundaries and develops a plan for remaining within the boundaries
		In Flight Planning	Adapts to the in-flight environment and appropriately develops a plan of action to complete the sortie
		Leading	Student has the ability to forecast formation position and translate this information into appropriate maneuver control and direction for the flight
		Low Level lost procedures	Applies proper procedures to recover from a lost situation and returns to the known/planned course
		Risk Management	Understands the risk around the aircraft/flight and develops an appropriate response to the risk
		Timing	Ability to apply proper procedures to correct for timing issues while in flight
		Wind Correction	Ability to apply proper procedures to correct for wind issues while in flight
Aircraft Specific	Information/Data Processing	Comm in instrument patt	Appropriately processes information passed by the ATC controller and other aircraft while in the instrument pattern
		Fix-to-fix	Incorporates all available information to fly a proper fix-to-fix
		In Flight	Ability to accurately interpret and analyze given information
		Instrument Approaches	Incorporates all available information to fly a proper instrument approach
		TOLD	Appropriately calculates and/or interprets given take-off and landing data; understands the implications of TOLD information
Aircraft Specific	Advanced Formation	Tactical Position	Attains and maintains a proper tactical formation position
		Tactical Rejoins	Applies proper procedures to fly an expeditious, safe tactical rejoin
		Tactical Turns	Applies proper geometry to turn at the proper time to maintain position following a tactical turn
Aircraft Specific	Crew Coordination	Brief/Debrief	Covers in appropriate detail crew and flight coordination to successfully complete the mission; appropriately identifies and addresses weaknesses in crew/flight coordination from the flight
		Flight Discipline	Maintains a proper level of professionalism in the cockpit while in flight
		Flt/Wingman Coordination	Considers the experience and comfort level of all flight and crew members when conducting the mission
		In-flight Checks	Conducts the appropriate in-flight checklist items in a timely manner

Broad Area	Skill Specific	UPT Event	Definition and application to skill area
Aircraft Specific	Mental Calculations	Enroute Descent	Appropriately calculates descent point
		Enroute Procedures	Applies proper mental calculations and rules of thumb to successfully complete the enroute portion of a flight
		Fix-to-fix	Applies proper mental calculations to achieve a successful fix-to-fix
		Fuel balance checks	Can conduct and calculate fuel balance checks in a timely manner
		Ground Speed Checks	Ability to calculate ground speed in a timely manner and apply this information to other calculations (timing, fuel, etc)
		Holding	Ability to apply wind and timing correction factors using mental calculations
		In-flight planning	Ability to mentally perform necessary calculations to determine time, fuel, distance, and other factors affecting the flight
		Status Change	Able to interpret status changes and incorporate calculations into profile changes and recalls as necessary
		T-38 fuel comp	Can conduct and calculate fuel balance checks in a timely manner
		TOT	Can apply calculations to update speed to achieve a TOT
Aircraft Specific	Quick Thinking	Basic Formation	Timely application of control inputs to maintain formation
		Dynamic Environment	Ability to adapt to a rapidly changing in-flight environment and make profile changes as needed
		FM	Ability to translate visual cues into aircraft control inputs to achieve positional requirements
		In-flight Checks quickly	Completes in-flight checks in a timely manner while maintaining aircraft and flight control
		Leading	Timely reaction vs planned events; flexibility
		Rejoins	Adjusts aircraft control inputs as needed to safely and expeditiously achieve a rejoin
		Status/fuel changes	Ability to make a timely decision concerning status and fuel state changes
Aircraft Specific	Target ID	In-Flight Planning	Adjusts aircraft direction as necessary to achieve target identification
		Maintaining Course	Maintains a proper aircraft heading to achieve target identification
		Mission Prep	Conducts appropriate mission planning and review to ensure proper target identification; utilizes all available resources to assist in target recognition
		Pilotage	Uses proper pilotage to achieve target identification
		Turn-Point ID	Uses proper pilotage to achieve turn-point identification
Aircraft Specific	Map Reading	Course Maintenance	Properly interprets map data to achieve low level course requirements
		Heading Control	Uses the map appropriately to maintain heading control
		Mission Planning	Plans, completes, and interprets all available map/chart data to successfully complete the mission (not just low level)
		Pilotage	Appropriately interprets the map for pilotage to achieve successful low level navigation
		Threat Awareness	Is the student able to interpret threats presented on the map and adjust the planning and/or mission profile?

Broad Area	Skill Specific	UPT Event	Definition and application to skill area
Other	Attitude	Brief/Debrief	Does the student accept the facts and not use emotion in the brief/debrief?
		Emotion	Does the student speak the facts or use feelings?
		In flight	Is the student an active participant in flight? Does the student talk back or just acknowledge without appropriate changes in behavior?
		Self-Improvement	Does the student take previous lessons learned and make attempts to improve?
Other	Mission Planning	Brief/Debrief	Is the student ready at brief/debrief time, listen intently, respond when queried?
		GK	Is the student prepared for the mission in terms of knowledge preparation?
		Mission Materials	Are the mission materials correct and appropriate for the mission? Thoroughness of mission materials
		Preparation	Has the student utilized the appropriate amount of time preparing for the sortie?
		Profile	Has the student developed an appropriate profile to meet training needs and maximize training opportunities?
		Study Habits	Does the student utilize his/her time appropriately when preparing and studying for a sortie?
Other	Precision Flying	Approaches	Accurately flies the instrument approach procedures to a minimum designated altitude
		Basic Control	Ability to maintain heading, altitude and airspeed to established parameters
		Close Trail	Ability to maintain proper position
		Fingertip	Ability to maintain proper position
Other	LOS Interpretation	Extended Trail	Ability to interpret a dynamic changing environment and proper use of pursuit curves to obtain and maintain a proper position
		FM	Ability to interpret a dynamic changing environment and proper use of pursuit curves to obtain and maintain a proper position
		Rejoins	Ability to interpret a dynamic changing environment and proper use of pursuit curves to obtain and maintain a proper position
		Tac Position	Ability to recognize deviations and positively correct back to a proper tactical position
		Tac Turns	Ability to recognize line of sight change and turn appropriately to maintain tactical position following a turn
Other	Compartmentalization	Discretion	Does the student temper his/her actions?
		IP to Target	Does the student fixate on target or does he consider his surroundings
		Mission Planning	Ability to limit external factors from impacting planning and prep
		Risk Management	Does the student dwell on multiple risk areas at once or does the student consider the nearest, highest threat potential?
		Task Management	Does the student approach one task at a time or is the student able to properly execute multiple task simultaneously?

Appendix H Student Skills Survey

The following survey was developed to be sent to the RTU instructors to complete on volunteer students to provide validation data.

For the student listed, answer the following questions concerning the student's current flying ability/skill. Do not consider any previous experience the student may have or any other external information.

1) Advanced Formation – the ability to fly non-scripted, tactical and advanced formations; the ability to make positive corrections to be in position or aggressive return to position.

1 2 3 4 5 6 7 8 9 10

Comments: ____

2) Cognitive/Spatial Thinking – the students ability to think beyond his/her aircraft and consider not only current events but future affects and events on not only the aircraft but formation.

1 2 3 4 5 6 7 8 9 10

Comments: ____

3) Communication/Listening - hearing, receiving, processing and understanding verbal and non-verbal cues inside and out of the cockpit.

1 2 3 4 5 6 7 8 9 10

Comments: ____

4) Crew/Flight Coordination – Pre-flight, in-flight, and post-flight coordination and conduct with other crew members in the aircraft and in the formation.

1 2 3 4 5 6 7 8 9 10

Comments: ____

5) Information/Data Processing – ability to accurately interpret and analyze given information (cockpit, radio, display, etc).

1 2 3 4 5 6 7 8 9 10

Comments: ____

6) Map Reading - read and interpret any and all information presented in map/chart form

1 2 3 4 5 6 7 8 9 10

Comments: ____

7) Mental Calculations - ability to accurate and quickly make computations on the ground and more specifically, in flight.

1 2 3 4 5 6 7 8 9 10

Comments: ____

8) Quick Thinking - proper decisions made without delay in the mission profile; timely reaction vs planned events; ability to cope with flexibility

1 2 3 4 5 6 7 8 9 10

Comments: ____

9) Target ID – properly identify and distinguish points on the ground

1 2 3 4 5 6 7 8 9 10

Comments: ____

Appendix I ENJJPT Working Group Agenda

The ENJJPT Working Group will refine the already built value hierarchy, skill sets, and relationships and use the following group goals:

- Global weightings for hierarchy
- Skill set definition
- Narrowly define measures.

The Wing leadership will be out-briefed on the working group results.

The following agenda will be used:

Time Needed	**Timeline**	**Item**	**Notes**
10 min	0800	Overview/VFT concepts Issue/Problem Statement	Is the system broke?
20 min	0810	What makes a good pilot?	Brainstorming 10 x Sticky pads
15 min	0830	Confirm Hierarchy Broad area breakdown	Flight Command input issue?
30 min	0845	Refine UPT individual event weightings	Poker chips
10 min	0915	Break	
15 min	0925	Relationship between T-37/T-38 daily rides and checkrides	1000 x Poker chips
50 min	0940	Relate Fighter Skills to UPT events	Brainstorm
10 min	1030	Break	
10 min	1040	Fighter A/C broad area weightings	
10 min	1050	Summary/Re-cap	

The working group will consist of the following ENJJPT instructors (prefer instructors who have been flying >1 year as an IP):

- US SNR Lt Col Brad O'Connor
- OG rep Maj Bruce Dobbins
- OGT rep *TBD*
- T-37 FAIP Lt Lucas Gruenther
- T-38 FAIP Capt Josh Schore

- A-10 background Capt Garret McCoy
- F-15C background Capt Jon Elza
- F-15E background Maj George Truman
- F-16 background Capt Peter Vega
- B-1 background Capt Shelby Bell
- B-52 background Capt Chris Otis

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From – To)*
01-06-2006	**Graduate Research Project**	September 2005 – June 2006

4. TITLE AND SUBTITLE

IMPROVING THE UPT STUDENT FOLLOW-ON ASSIGNMENT SELECTION PROCESS

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Messer, Michael G, Maj, USAF

5d. PROJECT NUMBER
AFIT/ENS/IOA-06-07

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)
Air Force Institute of Technology
Graduate School of Engineering and Management (AFIT/EN)
2950 Hobson Way
WPAFB OH 45433-7765

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT/IOA/ENS/06-07

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
80 FTW (Lt Col William O'Connor and Maj Bruce Dobbins)
1911 J Ave Suite 1
Sheppard AFB, TX 76311
DSN 736-5039/0415

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

13. SUPPLEMENTARY NOTES

14. ABSTRACT
The Euro-NATO Joint Jet Pilot Training (ENJJPT) program at Sheppard AFB conducts Undergraduate Pilot Training (UPT) for 13 NATO nations with a focus on producing premier fighter pilots. As ENJJPT transitions to the new T-6 Texan II, the leadership is examining if the current assignment model meets the needs of the US Air Force for the US students. To assign US students, the Senior National Representative uses the Merit Assignment Scoring System (MASS) to rank order students and assign aircraft based on preference and availability of assignments. MASS accounts for every activity in pilot training as well as a subjective input from the instructors as to the overall attitude and performance of the student. The score obtained from the MASS is categorical by assigning a weighting to a particular category performance. Currently, there is no direct link between the skills needed to fly modern fighter aircraft and the MASS. Additionally, many of the skills learned in pilot training span multiple categories and it is possible for a deficiency to be buried in the MASS score. The goal of this research was to identify the core skills required to fly the various fighter aircraft through the use of a Combat Air Forces (CAF) wide survey instrument, interviews, and working group inputs. An assignment model was created with a focus on assigning students based on skill strengths. After the core skills were identified and related to UPT events, a value hierarchy was created and a model developed to identify the best aircraft fit for a student based on their performance as related to the skill sets. This paper frames the issues, outlines the methodology used to define the skill sets, and discusses the development of the model. Finally, recommendations are made on future changes to MASS, the UPT student assignment process, and the pilot training syllabus.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF: UNCLASSIFIED			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
REPORT	ABSTRACT	c. THIS PAGE			**Dr John O. Miller**
U	U	U	UU	91	19b. TELEPHONE NUMBER *(Include area code)* (937) 255-6565, ext 4326; e-mail: john.miller@afit.edu

Standard Form 298 (Rev: 8-98)
Prescribed by ANSI Std. Z39-18